FLOOD PLAIN INFORMATION

FLOOD PLAIN
MANAGEMENT SERVICES
NEW ENGLAND DIVISION
CORPS OF ENGINEERS

WHITE RIVER, SECOND BRANCH, THIRD BRANCH & AYERS BROOK, RANDOLPH AND BETHEL, VERMONT

FLOOD OF 1927

PREPARED BY THE DEPARTMENT OF THE ARMY, NEW ENGLAND DIVISION,
CORPS OF ENGINEERS, WALTHAM, MASSACHUSETTS

DECEMBER 1973

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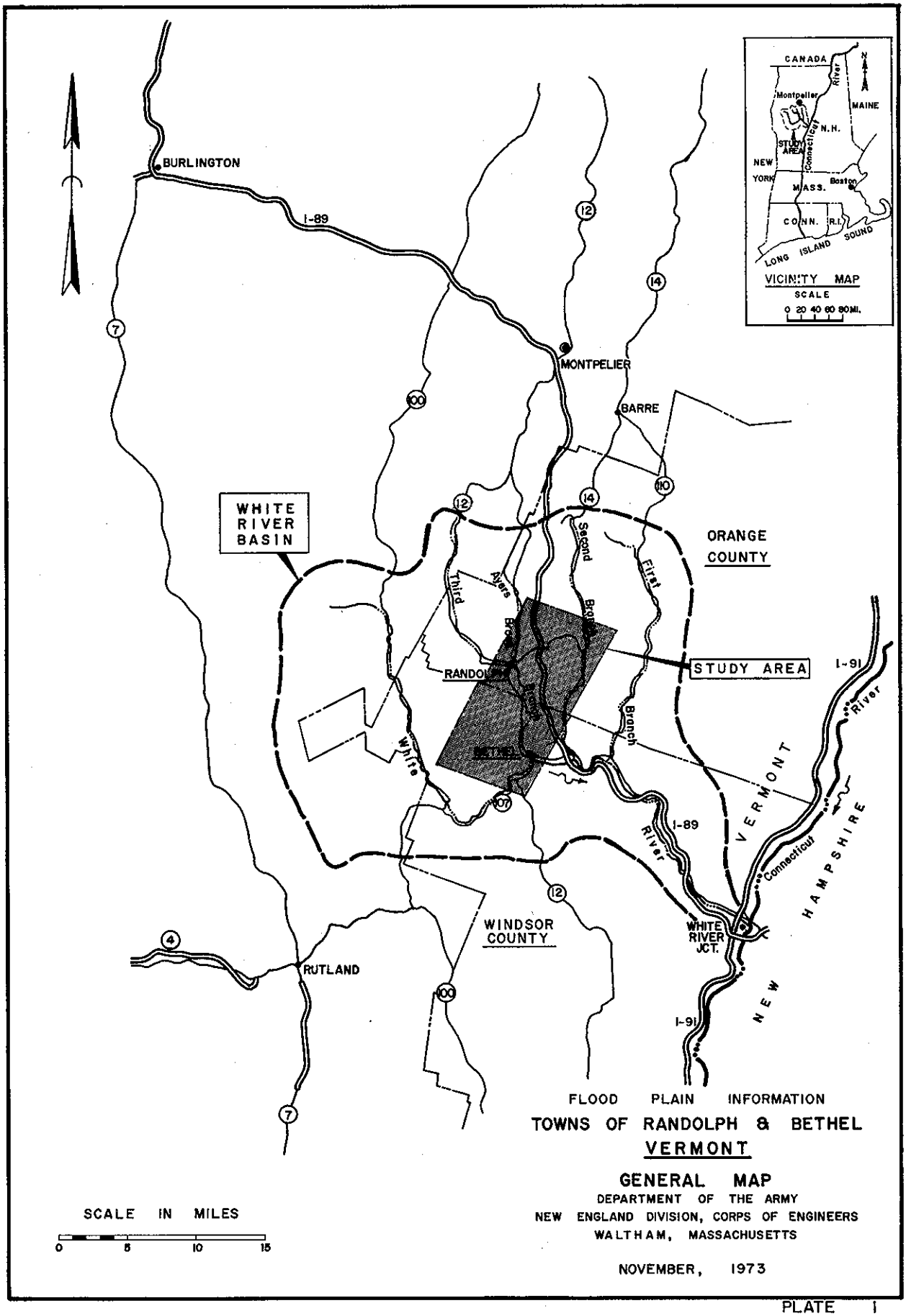


FLOOD PLAIN INFORMATION

TOWNS OF RANDOLPH & BETHEL

VERMONT

GENERAL MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

NOVEMBER, 1973

PLATE 1

PREFACE

The portions of the towns of Randolph and Bethel covered by this report are subject to flooding by the White River, Third Branch, Second Branch, and Ayers Brook. The properties along these streams are primarily agricultural and residential, with some industrial, and have been severely damaged by past floods, particularly that of November 1927. The open spaces in the flood plains which may come under pressure for future development are moderate. Although large floods have occurred in the past, studies indicate that even larger floods are possible.

This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization. It includes a history of flooding in Randolph and Bethel and identifies those areas that are subject to possible future floods. Special emphasis is given to those floods through maps, photographs, profiles, and cross sections. The report does not provide solutions to flood problems; however, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development and thereby prevent intensification of the loss problems. It will also aid in the identification of other flood damage reduction techniques such as works to modify flooding and adjustments, including flood proofing, which might be embodied in an overall Flood Plain Management (FPM) program. Other FPM program studies -- those of environmental attributes and the current and future land use role of the flood plain as part of its surroundings -- would also profit from this information.

At the request of the Boards of Selectmen for the towns of Randolph and Bethel, and with the endorsement of the Vermont Department of Water Resources, this report was prepared by DuBois and King, Inc., Engineering and Environmental Services, under the direct supervision of the New England Division of the U. S. Army Corps of Engineers, under the continuing authority provided by Section 206 of the 1960 Flood Control Act, as amended.

Assistance and cooperation of the U. S. Geological Survey, the Soil Conservation Service, the White River Valley Herald newspaper, State and local officials and private firms and citizens in supplying useful data for the preparation of this report are appreciated.

Additional copies of this report can be obtained from the Boards of Selectmen for Randolph and Bethel. The New England Division of the Corps of Engineers, upon request, will provide technical assistance to planning agencies in the interpretation and use of the data presented, as well as planning guidance and further assistance, including the development of additional technical information.

BACKGROUND INFORMATION

Settlement

The charter of the Town of Randolph was granted in 1781 to a group of about 40 proprietors mostly from the area around what is now Hanover, New Hampshire. Early growth centered chiefly around farming and sheep herding on Randolph Hill and a settlement grew in what is now Randolph Center. Times were quite prosperous and Randolph Center very nearly became the Capitol of the newly formed State of Vermont, losing out in a compromise decision to Montpelier. The Vermont Central Railroad came through the Town with its roadbed in the valley of the Third Branch in 1848, and shortly thereafter completed its line from Burlington to White River Junction. The coming of the railroad caused a shift in population and importance from Randolph Center to the low lying community which is now the Village of Randolph. The cheap bulk transportation offered by the railroad spurred the lumber, foundry, and dairy industries as well as the already established farm related businesses. Coincident with this was the great western U. S. expansion, with a net result of only modest population growth. In Randolph Center, an education institution known as the Orange County Grammar School was founded in the early 1800s. Since then, the institution has undergone several changes in educational emphasis from teaching to agriculture, and is now known as Vermont Technical College. Following the arrival of the railroad, a long period of middling prosperity lasted well into the 1900s. The decline of the railroad and lack of modernization has faded out many of the early industries, but a pattern has developed of gradual replacement by more modern industries. Today, agriculture remains as the economic backbone of the Town. The plastics, furniture, and woodworking industries have become established as well as several small but thriving service industries. The completion of Interstate 89 through Randolph in 1969 and the recent expansion of Vermont Technical College has spurred new interest in the area and hopes are high for a prosperous future.

Bethel was the first town in the State to receive a charter from Vermont which was issued December 29, 1779. About six families had settled there by 1780 and a fort was built as a frontier protection. By 1800 the inhabitants numbered 900 and included many Revolutionary War veterans from Connecticut and Massachusetts who settled along the White River and its branches. Small neighborhood mills were built in East Bethel and along the tributary streams, but Marsh's Mills, built in 1780 on the Third Branch with its excellent source of water power soon became the center of business activity in the Village. Two brick yards were in operation in the early 1800's which supplied material for more comfortable homes and by 1830 the population of the town had risen to 1600.

Farming was the main industry. Hops and flax were raised as well as food for families and livestock. Sheep raising suited to the rough terrain, was beginning its rapid development. On June 28, 1848, the first passenger train of the Vermont Central steamed up the valley to Bethel from White River Junction. Also, the White River Valley Railroad served Bethel and Rochester until it folded in 1933. In Bethel a short line was installed to transport granite from the "Bethel White" quarries on Christian Hill to the stone sheds. The business died a lingering death in 1923. The large payrolls of the granite company, the tannery, the shoe shop, and other smaller businesses contributed to the 1890-1920 period of prosperity. The number of dwelling houses doubled between 1890 and 1900. A slowing of growth came in the 20's and the years following when two wars, the stock market crash, hurricanes and floods and world wide conditions brought depression to the farmers and merchants. Today the old mill business is still in operation, now in the sale of grain and building materials. Other businesses include plastic precision molding, the manufacture of trailers and recreational vehicles, industrial machinery and various distributive and service businesses. The Interstate Highway has substantially replaced the railroad as the main artery of commerce. A few good farms still survive. Many of the abandoned farm buildings are being restored for vacation or retirement living.

The Stream and its Valley

The White River basin, with a total drainage area of 712 square miles and a length of 58 miles, is entirely in Vermont. It joins the Connecticut River from the west at White River Junction. The headwaters of this river are on the slopes of the Green Mountains in the Town of Ripton at an elevation of approximately 3,750 feet. The entire basin has a rugged terrain and steep slopes with few lakes or ponds and no significant falls. The White River joins with its three principal tributaries (the First, Second, and Third Branches) within the relatively short distance of 7 miles. These tributaries all flow from north to south and are roughly parallel.

The White River enters the Town of Bethel in a northeasterly direction and takes an easterly bend at Bethel Village before entering Royalton. The total length in the study area is 4.4 miles, and the drainage area at the Bethel-Royalton line is 409 square miles. The average fall is 13.6 feet per mile.

The Third Branch has its headwaters in the Town of Roxbury, and flows southerly to its confluence with the main branch in Bethel. The stream enters the Town of Randolph in an easterly direction through Randolph Village and then meanders southerly to Bethel. The length of the Third Branch in the study area is 11.5 miles, and the drainage area at its mouth is 136 square miles. Above Randolph, the stream has an average fall of about 25 feet per mile, and below Randolph flattens out to approximately 6.1 feet per mile. In the Bethel Village area there is a narrow rapids section, dropping about 25 feet in a linear distance of 500 feet.

The Second Branch has its headwaters in the Town of Williamstown, and flows southerly to its confluence with the main branch in Royalton. The total drainage area at its mouth is 73 square miles. In the study area, the stream runs parallel to the eastern boundary of Randolph and crosses through the northeast corner of Bethel. The confluence with the main branch is in Royalton, and therefore not covered in this report. The length of the Second Branch in the study area is 10.4 miles. As the stream enters the Town of Randolph the fall increases from 10 feet per mile to about 25 feet per mile. The stream then gradually levels off to a fall of about 7.3 feet per mile as it leaves the study area.

Ayers Brook is a tributary to the Third Branch with headwaters in the Town of Brookfield. The length in the study area is 4.9 miles and the stream has a drainage area at its mouth of approximately 38 square miles. It is a fairly steep stream with an average fall in the study area of 18.7 feet per mile.

Drainage areas contributing to runoff at locations in or near the study area are shown in Table I.

TABLE I

DRAINAGE AREAS

Location	Drainage area sq. mi.
White River, at Rood State Park	240.9
White River, at River St. Bridge, Bethel Village	273.0
White River, at Bethel-Royalton Town line	409.0
White River, at mouth, White River Junction	712.0
Third Branch, above Thayer Brook	52.8
Third Branch, Main St. bridge, Randolph Village	59.1
Third Branch, at Stock Farm meadows, below Ayers Brook	96.9
Third Branch, below Gilead Brook	124.7
Third Branch, Bethel Mills dam, Bethel Village	136.0
Ayers Brook, Peth Rd. bridge	21.6
Ayers Brook, USGS gaging station at Forest St. bridge	30.5
Ayers Brook, at Rte 66 bridge	37.8
Second Branch, North Randolph	23.7
Second Branch, East Randolph dam	41.2
Second Branch, South Randolph, above Peak Brook	52.5
Second Branch, sawmill dam, East Bethel	63.2
Second Branch, Bethel-Royalton Town line	64.4
Second Branch, confluence with White River, North Royalton	73.0

The U. S. Geological Survey has recorded flows in the White River basin at three different sites for varying periods. The three stations are the White River at West Hartford, (1913 - present), White River at Bethel (1931-1955), and Ayers Brook at Randolph (1940 - present).

The White River basin has the variable climate characteristics of mild summers and cold winters similar to the majority of northern New England. Annual precipitation is about 36 inches in valley areas to about 50 inches in the upper elevations. Snowfall data is unreliable due to the many variables including tree cover and elevation. Mean annual temperature is about 44 degrees Fahrenheit. Freezing temperatures can be expected from late September to early May, while summer temperatures average between 60 and 70 degrees Fahrenheit.

Developments in the Flood Plain

In general, the flood plains of the study area are relatively narrow and the majority of the land is equally divided between woodlands and agricultural areas. There are, however, significant and sizable developments at certain locations.

The River Street residential portion of Bethel village is a fairly extensive development on the flood plain of the White River. Also the foundation of a Vermont Public Service dam remains in place just downstream of the Bethel-Royalton Town line. Although this site is out of the study area, it affects flooding in Bethel.

There are several areas of development on the plain of the Third Branch in the Randolph Village area. A playground recreational park including swimming pool is located in the lower School Street area. There is also a low impoundment dam for the village water supply at the playground location. Downstream from the Main Street bridge, the old Sargent, Osgood, and Roundy Plant still stands. On the wide plain surrounding the confluence of the Third Branch and Ayers Brook are located a concrete plant, the village garage and sewage treatment plant, and some single and multi-family residential developments. Between the Randolph and Bethel village areas, the only developments are agricultural except for the tracks of the Central Vermont Railroad. In Bethel village, however, the Third Branch narrows considerably and there is a concentration of industrial and commercial developments quite close to the banks. Compounding the congestion is a large mill dam across the Third Branch at the head of the rapids portion. Below the rapids is a wider lower plain area before the stream empties into the main branch. This plain was the site of a large wood products plant until its destruction by fire in 1970.

The flood plain of Ayers Brook is almost completely agricultural, except for some residential areas in Randolph Village. It joins the Third Branch in the wide plain mentioned above and contributes to flooding in that area.

The plain of the Second Branch is almost exclusively devoted to farming and is developed only in small communities. In North Randolph, the remnants of an old mill dam remain. It is significant that the mill it served was reportedly destroyed in the 1927 flood. However, the majority of buildings in North Randolph at that point lie on high ground above the narrow valley. Conversely, much of the community of East Randolph, especially the north end, is situated on the flood plain. A small dam, formerly used for electric power generation, is located at the Route 14 highway bridge in East Randolph. Some buildings of the small commercial area lie quite close to the backwater from the dam. The community of South Randolph is situated on the foot of a hill, mostly off the flood plain. In East Bethel however, a small dam serving a saw mill and the main village bridge, which has a fairly small waterway opening, constitute a point of congestion which can aggravate flooding problems. Fortunately, only a few dwellings would be affected, as most of East Bethel lies on high ground.

FLOOD SITUATION

Sources of Data and Records

Three U. S. Geological Survey gaging stations are located in the White River basin, with records for various periods since 1913. Records are generally good except during winter periods, when they are fair. The location and period of record for these stations are listed in Table 2.

TABLE 2
USGS GAGING STATIONS

White River Basin

Location	River Mile	Drainage Area (Square Miles)	Period of Record
White River at West Hartford	7	690	1913 - Present
White River at Bethel	27	241	1931 - 1955
Ayers Brook at Randolph	1.2	30.5	1940 - Present

The Corps of Engineers has been collecting information for many years on existing and prospective flood conditions and hazards in the White River valley. Investigations were made following most of the significant floods which have occurred in the area since and including that of November, 1927. Studies were also conducted in the area in connection with the Connecticut River Flood Control Report done by Corps of Engineers in 1940. Information such as high water marks have been obtained by interviewing local residents through the years and making field investigations. In addition, newspaper files and historical documents and records were searched for information concerning past floods. These records have developed a knowledge of floods which have occurred in Randolph and Bethel.

Maps prepared for this report were based on the U. S. Geological Survey Quadrangle entitled "Randolph, Vermont", dated 1957, aerial photographs taken in 1969 obtained through the USDA Soil Conservation Service, and limited photogrammetric maps.

Flood Season and Flood Characteristics

Major floods have occurred in the study reaches of the White River valley during all seasons of the year except mid-winter. Whereas spring is the normal period of high flow with its increased rainfall and snowmelt, it is by no means the only time of the year when flooding can occur. As in most of the wooded sections of New England, the runoff potential varies greatly with the season. When vegetation is dormant the storage provided

by plant life is low, leaving the area more vulnerable to flooding. In other words, equal storms will have different effects in, for instance, August and November. Due to the relative steepness and narrowness of the valley and its lack of natural lakes and swamps, flood waters can rise rapidly. Similarly, the duration of flooding is quite short lasting from a few hours to one or two days.

The White River valley is susceptible to various types of floods, but the most severe generally occur from storms delivering very intense rainfall in short periods, rather than the long lasting but less intense variety. This is probably due again to the steepness of the valley, allowing rapid runoff of rain water from the longer storms. The high intensity storms are typically of tropical origin. In addition to floods caused by rainfall alone, the area is subject to flooding caused by rainfall in combination with snowmelt and ice jamming or any combination of all three factors. Ice jams usually happen during the late winter or early spring but have occurred earlier in the winter.

Factors Affecting Flooding and Its Impact

Obstructions to floodflows - Natural obstructions to floodflows include trees, brush and other vegetation growing along the streambanks in flood plain areas. Manmade encroachments on, or over, the streams such as dams, bridges, culverts and indiscriminate filling in the flood plains can also create more extensive flooding than would otherwise occur. See figures 1 through 4 for representative obstructions.

Encroachments in the form of filling in the flood plain proportionately decrease the area of the floodway, resulting in higher stages upstream and a loss of natural storage capacity which increases the flood potential downstream. Although extensive filling is not in evidence in the Randolph-Bethel area, awareness of the potential problem is important.

During floods, trees, brush and other debris may be washed away and carried downstream to collect at bridges and other obstructions. As floodflow increases, masses of debris break loose and a wall of water and debris surges downstream until another obstruction is encountered. Debris may collect against a bridge until the load exceeds its structural capacity and the bridge is destroyed. The limited flow capacity of obstructive bridges retards floodflows and results in flooding upstream. This increased flooding contributes to erosion around bridge approach embankments and damage to overlying roadbeds.

It is difficult to predict the degree or location of the accumulation of debris; therefore, for the purposes of this report, it was necessary to omit this factor in the development of the flood profiles.

Although the dams on the streams in the study area will alter flow characteristics somewhat, none has appreciable flood storage capacity and therefore cannot be relied upon for flood control in any way.

The streams in the study area are spanned 25 times by bridges. Pertinent information on all bridges can be found in Table 6. Some bridges are obstructions to flood flows. Photographs of four of these bridges are shown in Figures 1 thru 4.

Flood damage reduction measures - A major multipurpose dam and reservoir project for the White River at Gaysville, just upstream from the study area, was authorized as early as 1936, but is presently listed as being in an inactive status.

At present, the Town of Randolph has zoning regulations governing use of flood plain areas. The regulations prohibit the construction of dwellings for human occupancy and the filling in or paving of land in flood plain areas, without Town approval. The Town of Bethel puts forth a similar statement in the municipal development plan, although the plan does not have the power of law. This study has been requested so that it may be used as an aid in further refinement of flood plain management regulatory measures.

Other factors and their impacts - Although floods in the White River basin are caused by the intensity of rainfall, rather than by volume, the topography of the basin is a contributory factor to the severity of floods and their rapid development. The streams feeding the major branches are relatively short and steep. This stream pattern combined with a lack of natural storage results in a very short time of concentration for the runoff to develop. In other words, the many tributary streams literally "dump" their contents almost simultaneously throughout the entire basin. With no storage available waters rise very rapidly in the main channels. Debris dams can form at constrictions. When these dams give way, a surge is created sometimes causing chain reactions downstream.

Flood warning and forecasting - The National Weather Service River Forecast Center at Hartford, Connecticut, has the responsibility for issuing flood warnings and forecasting river stages in the Connecticut River basin, which includes the White River and tributaries. The Weather Service also provides normal weather forecasts and quantitative precipitation forecasts. In addition, a network of rainfall and river reporting stations has been established with resident observers. The flood warnings and forecasts are issued by teletype to press services, state police, and other state and local agencies. Locally, the state police barracks in Bethel receive initial warnings from their headquarters in Montpelier and relay the warnings to local police, civil defense and the fire departments in Randolph and Bethel.

Figure 1 - Third Branch - Town road bridge, Bethel, at Mile 0.2.

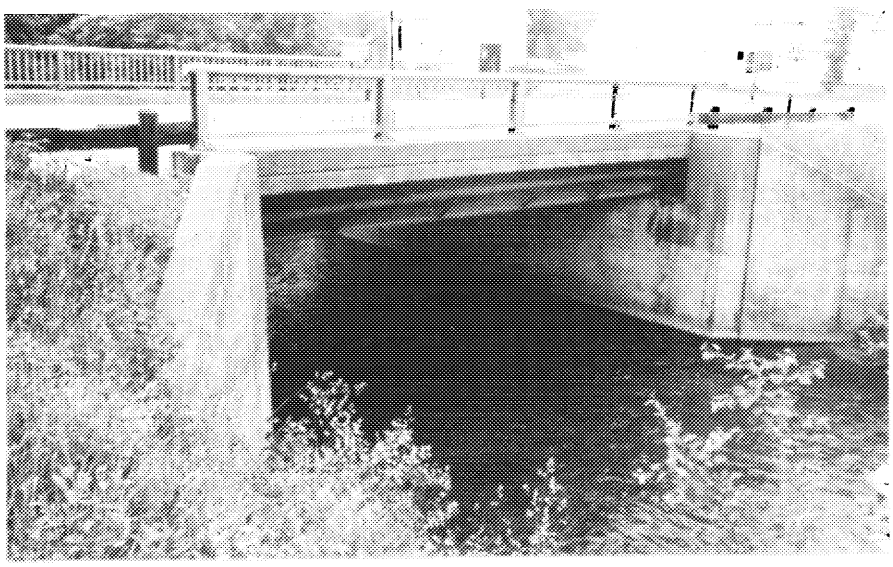


Figure 2 - Ayers Brook - Central Street bridge, Randolph, at Mile 0.2.

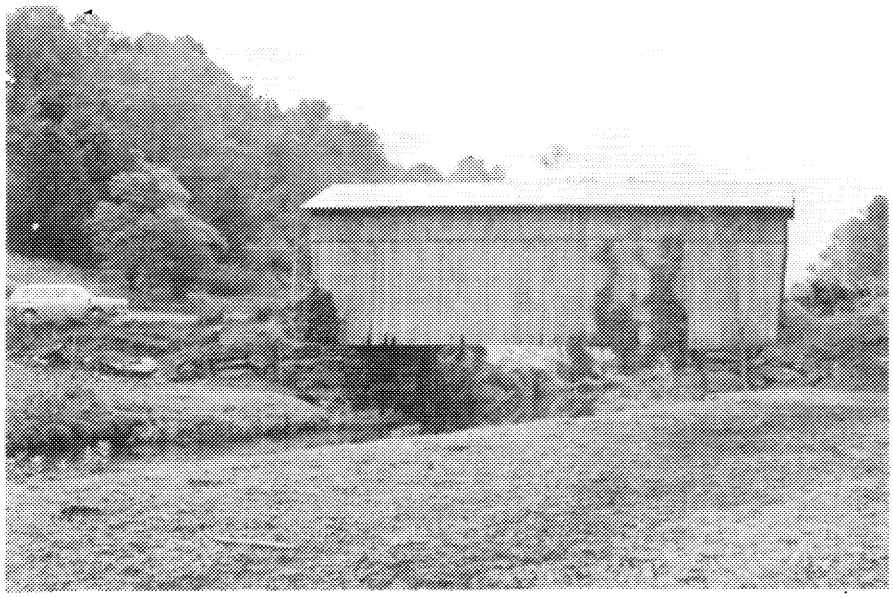


Figure 3 - Second Branch - Covered bridge above East Bethel, at Mile 5.0.

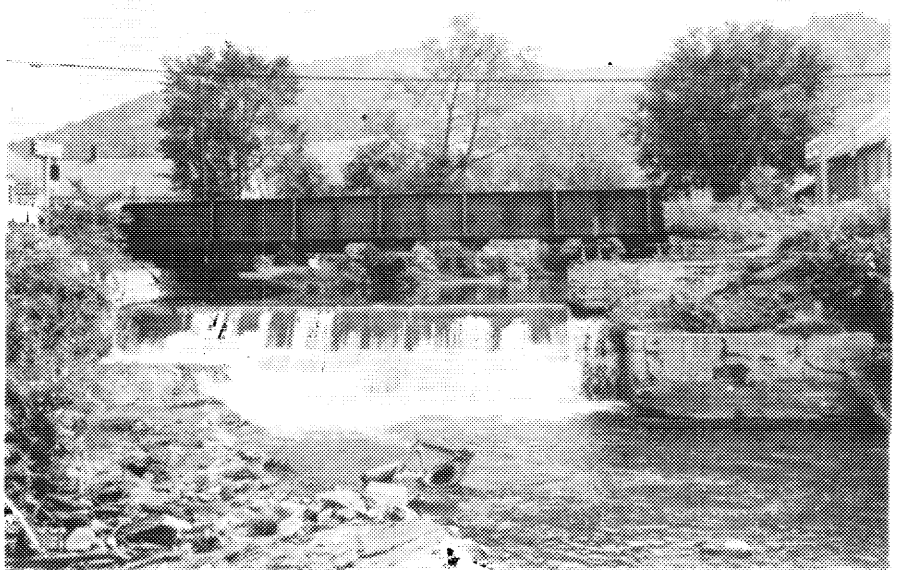


Figure 4 - Second Branch - CVPS dam and Route 14 highway bridge, East Randolph, at Mile 10.9.

Flood fighting and emergency evacuation plans - The Town of Randolph has a formal civil defense standard operation procedure involving evacuation, shelter, and chain of command. The civil defense has bedding, first aid equipment, and emergency communication and electric power facilities. Although Bethel has no formal flood fighting or evacuation plan, the fire department would be the main agency for coordinating efforts. The state police would also provide assistance.

Material storage on the flood plain - Streams with development along the banks could have quantities of floatable materials stored on flood plain lands, such as lumber, crates, large volume containers and storage tanks, and other materials which may be unrestrained and buoyant. During times of floods, these floatable materials may be carried away by flood flows causing serious damage to structures downstream and could clog bridge openings creating more hazardous flooding problems.

PAST FLOODS

Summary of Historical Floods

Damaging floods have been reported in the White River valley area as early as 1775 and as recently as June, 1973. Among these, the November 1927, flood is the greatest on record on the White River and its tributaries.

Flood Records

Information on historical floods in the Randolph and Bethel area was obtained from stream gaging stations maintained by the U. S. Geological Survey. Table 3 shows a listing of the highest discharges recorded at each location.

TABLE 3

DISCHARGE RECORDS

White River Basin, Vermont

Station	Period of Record	Peak Discharges (cfs)	
White River at West Hartford	1913 - Present	4 Nov 1927	120,000
		22 Sept 1938	47,600
		18 Nov 1936	45,400
		30 Jun 1973	42,300*
		12 Apr 1922	35,500
		29 Mar 1925	31,200
White River at Bethel	1931 - 1955	21 Sept 1938	32,200
		3 Jun 1947	20,200
		31 Dec 1948	19,900
		27 Mar 1953	17,600
		18 Mar 1936	16,100
Ayers Brook at Randolph	1940 - Present	30 Jun 1973	4,070*
		1 Jun 1952	3,490
		31 Dec 1948	2,120
		28 Nov 1959	1,330
		3 Jun 1947	1,310
		5 Mar 1964	1,200

*Discharge shown is provisional at time of publication, subject to change.

Flood Descriptions

The following are descriptions of past known large floods in the Randolph and Bethel area. These are based on newspaper accounts, historical data, and field investigations.

July 1830 - From the "Vermont Advocate", published at Royalton,

"Bethel, like most towns situated on streams of water, has suffered from freshets at various periods in its history. . . There had been a freshet two years earlier in 1828, causing some damage, and especially weakening the foundations of some of the buildings on the banks of the Third Branch of the river in the village. But about the 25th of July, 1830, there were unusually heavy rains, and yet it is hardly probable that these would have caused unusual damage had it not been that milldams along the Third Branch of the White River, in Braintree and Randolph gave way one after another, letting loose an enormouse flood of waters."

October 1869 - From a letter written by Charles Paine

"We were husking corn in the barn. It rained and rained and rained day after day. The Branch kept rising and there were lots of fields of corn in stooks all along up the line. Soon pumpkins began sailing down stream. The meadows became one vast lake and the water began picking up whole stooks of corn and carried them down stream piling them up against fences and trees."

April 1895 - From the Bethel Courier,

"The high waters of Saturday, Sunday and Monday of the past week was something unpredictable. It was certainly the worst flood since 1869 and probably since 1830. On Finlay Flats the water stood over the fences by the railroad and looking northward from Church Street nothing but an expanse of water met the eye. Sunday the big landslide occured at Blue Hill on the railroad. The enormous booms of the Fall Mountain Paper Co. at Gaysville broke and logs galore went to Bethel seeking Long Island Sound. . ."

From the Herald and News, Randolph,

"No such flood has been known in Randolph since July 27, 1830. . . The water in Branch River rose 8 feet and began to work around one end of the grist mill dam. . . On School Street, the water stood from 3 to 4 feet in the cellars of several houses. On Central Street, also, the water was very high. . ."

November 1927

The White River Flood of 1927 undoubtedly ranks as the most devastating tributary flood in Connecticut River history. Many volumes have been written describing the havoc wrought. The seriousness of the damage may be brought out by mentioning that nine lives were lost and direct damages exceeded four million dollars. This damage figure is almost equal to the total of all damages in the 1927 Flood in the Connecticut Basin, excluding Vermont. An excellent description of the flood is available in "Floodtide of 1927" by L. B. Johnson, publisher of the Herald and News at Randolph. Quoting from this publication,

"Several times within memory disastrous freshets have occurred at Randolph. Two years ago last March extraordinarily high water in the Branch washed around and carried out the Morse milldam, nearly destroyed the new bridge then almost completed and washed through the Sargent, Osgood & Roundy manufacturing plant. That freshet, bad as it was, fell far short of that of Nov. 3d, 1927, in point destructiveness.

"The new dam, constructed to take the place of the old one; the new cement bridge on Main street; river channel property, including lands and residences along School street; practically all the bridges leading into the village from every direction, and many others throughout the town; several homes in the outlying area, were destroyed. The Sargent, Osgood & Roundy plant was again sadly devastated.

"The railroad went out of business, with its mail, freight and express services. Ditto the telephone and telegraph. The water system was cut off. For a full day the wrecked bridges marooned the western corner of the town between Thayer Brook, the Branch and Beanville. No message by wire could get out or in."

"The long highway bridge across the White River to River street in Bethel village put up a strong fight against the flood. Neither abutment was undermined or gave away, and it is said that the bridge remained in place until water was going over it five to six feet deep, then the wreckage of houses and trees piled up against it about 20 feet high, making a dam out of it, and carried it away."

"River street was badly hit. For a hundred years people had said that sometime the river would cut across this street, and it did. . .In all, three dwellings went off on River street, besides the other buildings left standing but undermined."

SECTION 1

HERALD AND NEWS

Pages 1 to 6

VOL. LIV.--NO. 6-2815 RANDOLPH, VT., THURSDAY, NOVEMBER 10, 1927.

MORE THAN 100 DEAD IN AWFUL VERMONT FLOOD

Property Damage Reaches Millions--Unprecedented Rainfall Brings Deluge to Western New England

White River Valley in Center of Stricken Area.—Royalton and Sharon Each Furnish Three Victims.—Four Bridges Out in Bethel Village.—Gaysville and West Hartford Heavy Sufferers.—Milldam, New Cement Bridge and Much River Property Lost In Randolph.—Lieut.-Gov. S. Hollister Jackson and Six Others Perish in Barre.—Central Vermont Railroad Seriously Damaged.—Communication Cut Off for Days.—Food Situation Gives Concern in Some Towns.—Restoration Being Slowly Accomplished.

(From Herald and News Flood Extra ... and Monday ... other and later flood ... paper's part of the story)

This region, visited Thursday and Friday by the worst flood since the coming of the white man, is slowly pulling itself together and taking the first necessary steps toward restoring the essential services. The loss has been appalling—not so much in the millions of property destroyed or put out of use, or even in lives which has been comparatively small, as in the interruption of life's activities and the look ahead for the future.

In the White River valley, which was in the very middle of the storm area, six persons are known to have lost their lives. These were

Adolphus Hicks.

Almeda Hicks, his wife.

Charles Keay at Royalton.

Mrs. Claude Reynolds and two small daughters below Sharon.

The property loss can never be computed, for it runs ahead into the future and threatens to impair the economic life of many communities. Villages like Gaysville, Bethel and West Hartford, whose business or residential centers were almost ruined, will find it very hard indeed to rebuild or even carry on as they have. With the true Vermont spirit they will tackle it, and do all that can be done under the circumstances.

The flood resulted from very heavy rains that began here about 9 o'clock Wednesday evening and continued almost without interruption for over 36 hours. It is said that two storms met. The area visited seems to have been practically all of Vermont, and overlapped into eastern New York, western New Hampshire and northern Massachusetts. The downpour had a "filling" quality and the streams rose almost at once, and kept on rising until all previous high marks were obliterated. Everything on low ground or within reach of a running stream felt the flood's fury. If not washed away or dismantled, it was covered with slime and debris by the swift turbid rush.

Communication of all sorts, railway, highway, telephone, telegraph was cut off before dark Thursday and for a day or two many communities could not hear from or be heard by the outside world, and then only by some pedestrian making his way in or out. In consequence, news of disaster came slowly and is still far from complete. Even on Monday but a few telephone offices north or south could be reached and telegraph service did not reach so far, except as it was relayed by telephone over round about circuits. By devious hill routes, covering 70 miles, Bethel could be reached by auto, thence across the river by boat, and via Barnard and Woodstock to White River Junction, where travel is restored into New Hampshire. To the north one can reach Barre and Montpelier by auto, but up to Monday no one had gone farther than that and returned. So news from the flood area outside is meagre.

Radio and press dispatches quoted indicate a loss of life reaching more than 100. The Winooski valley contributed over 50 of these. Seven or eight perished in Barre, including Lieut.-Gov. S. Hollister Jackson and one in Montpelier. Very heavy loss of life occurred in Waterbury, Bolton and other towns further down.

Bellows Falls is known to have suffered heavily, with loss of paper mills, business property, etc. The Connecticut rose to new level all down its course, flooding wide areas through Massachusetts. Rutland was reported a heavy loser with several victims.

Railroad and highway bridges went out everywhere, the railroads being hit especially hard. The Central Vermont will have to be largely rebuilt through the Winooski, Dog and White River valleys.

Considerable apprehension was felt over the food supply in the stricken area and appeals went out for aid, but the situation seems to be in hand.

The hydro-electric plants at Blue Hill and Gaysville went out of commission by the diversion of the streams around the dams and the company serving White River valley must depend on its stations over the mountain. The wire from Randolph to Rochester was restored Sunday and service is on, the juice coming from the Silver Lake station at Brandon.

The radio gave much prominence to the flood. WBZ at Springfield especially broadcast many anxious messages and news reports. Airplanes sent out by newspapers and carrying passengers and supplies are a common sight.

DAM AND CEMENT BRIDGE WENT OUT AT RANDOLPH

Foundry Plant Again Decimated; River Front Residences on School Street Undermined.

The freshet of two years ago last April, which carried out the Morse milldam, nearly destroyed the new bridge then almost completed and washed through the Sargent, Osgood & Roundy plant in this village, was far less destructive than last Thursday's.

The new mill dam, constructed to take the place of the old one; the new cement bridge; river channel property including lands and residences along School street; practically all the bridges leading into this village from every direction, and many others throughout the town; several homes in the outlying area, are all gone. The Sargent, Osgood & Roundy plant was again sadly devastated.

The railroad went out of business, with its mail, freight and express services. Ditto the telephone and telegraph. The water system was cut off. For a full day the wrecked bridges surrounded the western corner of the town between Thayer brook, the Branch and Beanville. No message by wire could get out or in. All about were small detached areas out of touch with others nearby.

The Branch rose early in the day and by 4 o'clock was as high as at any time two years ago. It continued rising a foot an hour all the evening. A vast volume of water poured over the new milldam, rising rapidly until it ran over the platforms of both end anchorages covering the flumes.

Rush of Mighty Waters in Channel

The channel below the bridge was a rush of mighty waters which before long leaped the heavy stone embankment protection above the main foundry buildings and swept resistlessly through them in spite of the work of many men and trucks placing timbers, stone and sandbags in their way. By dark the situation appeared very dangerous. The people living on the Beach—the Arbuckle family, Frank Huntley and Emery Steele, had to get out. Arthur Bowen and Clarence Sager made their way to the Huntley house, broke in and helped Mr. Huntley to safety, then swam to the barn, loosed the horses and swam them out.

The electric system went out of business early, adding to the difficulty of the struggle, with the flood. Before 9 o'clock the water had risen so that it was flowing right across the south end of the cement bridge abutment and its protecting extension and lessening and washing out the earth embankment back of it on the upside of the stream.

A 500-lb. sow owned by Mrs. G. E. Fassett, who lives near the Branch, released to avoid drowning in its pen, took boldly to the stream and proved that hogs can swim by battling the current for a long time. Finally it was carried over the dam, but stuck it out and pulled ashore at the foundry safe and sound.

The floods stretched out both sides above the dam in the late

(Continued on page 3)

DAMAGE DONE THROUGHOUT THE WHITE RIVER VALLEY

Three Perish in Royalton and Three in Sharon.—Heavy Loss in Many Towns.

In White River valley the worst sufferer seems to have been Bethel village and town, where the loss is estimated at half a million dollars. The village especially, where the river, the railroad and the main business street are close neighbors, met with tremendous loss.

The Central Vermont railroad lost all of its three steel bridges in the town, the one at Findley bridge was twisted, the south abutment crumbling and letting the girders partly into the river. One end of the new bridge north of the Church street crossing in Bethel village lies in the river, the south abutment giving away. The steel bridge between the Church street crossing and the station is entirely gone and the tracks are torn up or made unsafe for over a mile through the town of Bethel. The Rochester or Pea Vine railroad suffered loss of its train and much of its track. The train, composed of engine, combination car and a car filled with grout, started for Rochester Thursday afternoon. It went as far as Goodell's mill four miles below Bethel and turned back to Bethel. It now lies partly buried in the sand and gravel against the tannery building, doubtless saving that from destruction.

Nearly All of Bethel Bridges Gone

Practically all the highway bridges in town were swept away. Beginning at the north the Church Hill covered bridge went, the Gilead brook taking a new course and surrounding three houses below the bridge and all of the road between the middle of Church Hill and the hill opposite was swept away. The covered Findley bridge and the new steel bridge over the main highway at the mouth of Camp Brook went out. The line bridge between Bethel and Stockbridge over Lillieville brook was washed away.

In Bethel village the Church street covered bridge was washed away and the steel River street bridge.

The Bethel pumphouse and machinery were swept away at a loss of $25,000.

The water went around the Blue Hill dam of the Public Service Corporation of Vermont but the dam and power station still remain.

Of damage to property of individuals, the barn of Frank Wilson on the Randolph road, together with six cows, were washed away, also four cows belonging to Lewis Edmunds. The houses of L. H. Whitney, Mrs. A. W. Mead and Will Mead at the north end of the village were undermined, also the new office of the White River Valley Telephone Co. The Child block, in which Dr. O. V. Greene's office is located, was not damaged.

A. N. Washburn lost his milldam, sawmill and wooden building connecting that with the gristmill and store. Mr. Washburn also lost several thousand dollars worth of grain and material, also lumber that was on the Arnold flat. The storehouse building of Brooks & Washburn Co., in the rear of the Blossom block, was swept away. The old shoe shop building on the west side

(Continued on page 4)

STORIES FROM THE OUTSIDE BY RETURNING RANDOLPHITES

Teachers Had Memorable Experience.—Situation in Barre and Montpelier Described.

The Randolph graded and high school teachers who visited schools in Montpelier last Thursday won't forget that visit soon. One carload started back on Barre and got as far as the Dix camp locality in East Randolph, where in the darkness they very narrowly escaped running into a stream where a bridge had just gone out. They hung up there over night, reaching home next day. In this party were Principal W. F. True, Assistant A. C. Perry, Mrs. Stanhope Brigham, Misses Pauline Lund, Ella Howe and Florence Fuller.

Superintendent and Mrs. G. A. Jamieson, son, Arthur, Mrs. Joel Fifield, Mrs. M. P. Morse, Mrs. Harold Simmons and Mrs. Fuller Slayton, coming in two cars, found it impossible to get further than three miles out of Montpelier on the Berlin road Thursday afternoon. They put up at adjoining farm houses two nights. Leaving their cars Saturday morning they walked to Northfield, seven miles, sometimes in water to their knees, following sometimes the road and sometimes track as necessity required. They found the underpass near Brown's mills washed out; the road completely blocked a little further on by a huge rock; the railroad bridge at Riverton out; a work train there over on its side; the Cox brook culvert at Northfield Falls out and the railroad washed away there; the new cement bridge between the Falls and Northfield down; the Nantana worsted mills at Northfield gutted; the old arch railroad bridge in the village out but the Main street bridge and milldam standing; much damage done to water level property and the town under martial law. Louis Morse brought the party to South Northfield, where they crossed two bridge washouts, were picked up on the other side by Arthur Bigelow and brought home via Brookfield.

Reports from farther north than Montpelier are meagre, but it is known that much loss came to all the lower Winooski valley. Waterbury is said to have been a heavy sufferer.

In general, the hill towns did not encounter so much loss as the river sections, and travel at present has to be mostly through them.

Barre Lost Several Lives and Much Property

Dr. and Mrs. J. W. Soules and George N. Stimets motored to Barre Sunday via Brookfield hill roads to view the situation there, which they found fully as bad as reported. Entering from South Barre, several houses near the Barclay works are upended. The business section suffered from an influx of water from Stevens branch and Potash brook. The streets were heavy with slime. Many of the stores and business blocks had been visited by the inrush with heavy loss in merchandise. Ladd's bakery was put out of business by a leakage of ammonia gas. Houses lining the streets at the north end were full of mud and being dug out by their owners. Even the concrete roadway was disrupted in places.

The dead in Barre numbered seven certainly. Among them was

(Continued on page 2)

Figure 5 - HERALD AND NEWS HEADLINE

Figure 6 - Bethel - November 1927 flood. Damage along the Third Branch looking upstream.

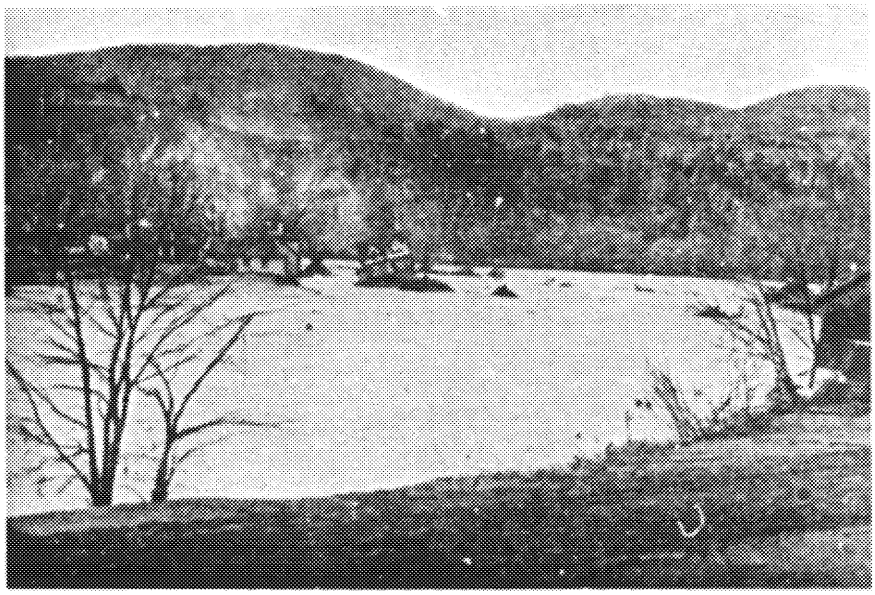


Figure 7 - Bethel - November 1927 Flood. River Street looking upstream on the White River. Photo taken after the old bridge washed out.

Figure 8 - Randolph - November 1927 Flood. Rear of School Street showing vast bank erosion.

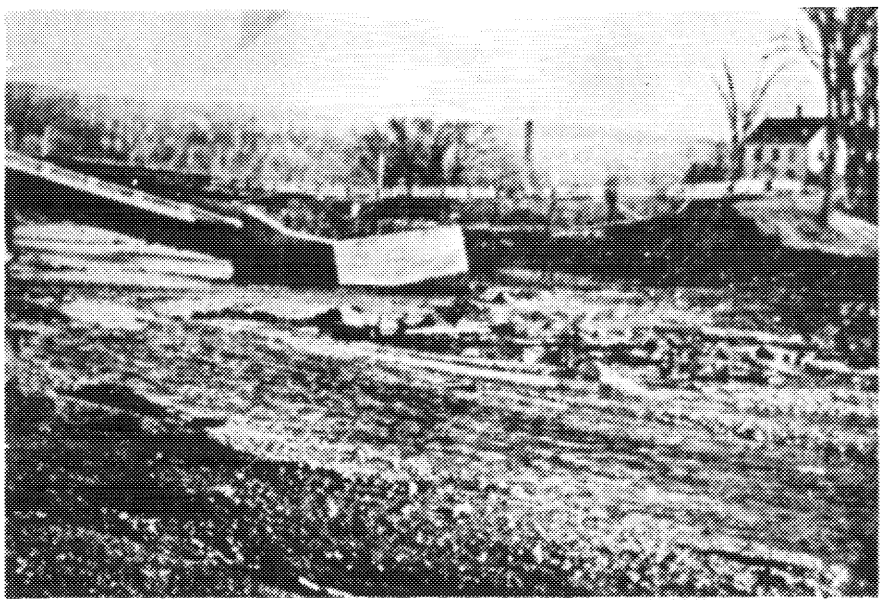


Figure 9 - Randolph - November 1927 Flood. Destruction of the former Main Street bridge, new at the time.

March 1936 - From the Herald and News, March 19, 1936,

"Yesterday, conditions became really alarming. Although the widened channel gouged by the flood nine years ago permitted a huge flow to pass down the Third Branch without serious trouble, after the ice departed, one could easily see what would have occurred, but for the widened courses resulting then. The channels were full and where banks were low, the water rolled out and spread over the meadows. An immense volume churned beneath the long Main Street bridge and past the foundry. . .The worse situation in Randolph Village arose at Hobart bridge on Lower Central Street. Ayers Brook raged high and strong. Impeded until about 10:30 by an ice jam near the Jerd slaughterhouse, it overflowed and rose almost to the level of the street and bridge by midafternoon. . ."

September 1938 - From the Herald and News, September 22, 1938,

"Dame Nature had one of her worst tantrums this week. In her bad moods she has dealt us big floods like those of '27 and '36, and sometimes an earthquake or a big wind, but this time she poured flood waters upon us until we were nearly drowned and then at the very peak of that, sent along a regular Florida hurricane, combining "two shows in one". . .Locally, the loss was far less in some ways than '27, but much more widespread, especially in the rural sections and highlands where the wind wrought devastation."

June 1973 - From the White River Valley Herald, July 5, 1973,

"The White River Valley area was one of the hardest hit, although not quite so badly as a bit south in the state. Damage amounted to $1 million or more. Various weather stations around the area, including the official one kept by Elizabeth Taplin in Chelsea, measured rainfall in the 48-hour period of Friday and Saturday at about 5 inches. One station measured an inch in one tumultuous hour Saturday. . .Perhaps 100 roads in the area were impassable; virtually all dirt roads were badly washed; about a score of bridges were knocked out. . ."

FUTURE FLOODS

Floods of the same or larger magnitude as those that have occurred in the past could occur in the future. Larger floods have been experienced in the past on streams with similar geographical and physiographical characteristics as those found in the study area. Similar combinations of rainfall and runoff which caused these floods could occur in the Randolph and Bethel area. Therefore, to determine the flooding potential of the study area, it was necessary to consider storms and floods that have occurred in regions of like topography, watershed cover and physical characteristics. Discussion of the future floods in this report is limited to those that have been designated as the Intermediate Regional Flood and the Standard Project Flood. The Standard Project Flood represents a reasonable upper limit of expected flooding in the study area. The Intermediate Regional Flood may reasonably be expected to occur more frequently although it will not be as severe as the infrequent Standard Project Flood.

Intermediate Regional Flood (IRF)

The Intermediate Regional Flood is defined as one that could occur once in 100 years on the average, although it could occur in any year. It might be better described as a flood with a 1% chance of occurring each year. The determination of the Intermediate Regional Flood was based on a statistical analysis in which the records of the two short term stations in the basin were correlated with the long term record at West Hartford. Peak flows thus developed for the Intermediate Regional Flood at selected locations in the study area are shown in Table 4.

Standard Project Flood (SPF)

The Standard Project Flood is defined as a major flood that can be expected to occur from a severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the study area is located, excluding extremely rare combinations. The Corps of Engineers, in cooperation with the Weather Service, has made comprehensive studies and investigations based on the past records of experienced storms and floods and has developed generalized procedures for estimating the flood potential of streams. Peak discharges for the Standard Project Flood at selected locations in the study area are shown in Table 4.

TABLE 4

PEAK FLOWS FOR INTERMEDIATE REGIONAL

AND STANDARD PROJECT FLOODS

Location	Drainage Area sq.mi.	Intermediate Regional Flood Discharge cfs (a)	Standard Project Flood Discharge cfs (a)
White River at Bethel-Royalton Line	409	64,000	103,000
Second Branch at Mouth	73	15,000	25,000
Third Branch at Mouth	136	29,000	49,000
Ayers Brook at USGS Gage	30.5	5,700	10,000

(a) cfs - cubic feet per second

For purposes of comparison, the following table shows crest elevations of the November 1927, June 1973, the Intermediate Regional, and the Standard Project floods at the River Street bridge in Bethel.

TABLE 5

FLOOD ELEVATIONS

Flood	White River at River Street Bridge, Bethel Elevation (ft. msl) (a)
Standard Project	545.7
November 4, 1927	542 (b)
Intermediate Regional	537.6
June 30, 1973	531.5 (c)

(a) Top of roadway, elevation 546.0
(b) Approximate - modified to reflect present-day conditions (i.e., downstream CVPS dam in existence in 1927 has now been substantially removed.)
(c) Provisional at time of publication, subject to change.

Frequency

A frequency curve of peak flows was constructed on the basis of available information and computed flows of floods up to the magnitude of the Standard Project Flood. The frequency curve thus derived, which is available on request, reflects the judgment of engineers who have studied the area and are familiar with the region; however, it must be regarded as approximate and should be used with caution in connection with any planning of flood plain use. Floods larger than the Standard Project Flood are possible but the combinations of factors necessary to produce such large flows would be extremely rare.

Hazards of Large Floods

The extent of damage cuased by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. An Intermediate Regional or Standard Project Flood on the White River and tributaries would result in inundation of residential, commercial, and industrial, as well as agricultural sections in the study area. Deep flood water flowing at high velocity and carrying floating debris would create conditions hazardous to persons and vehicles attempting to cross flooded areas. In general, floodwater 3 or more feet deep and flowing at a velocity of 3 or more feet per second could easily sweep an adult person off his feet, thus creating definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed, or in vehicles that are ultimately submerged or floated. Water lines can be ruptured by deposits of debris and the force of floodwaters, thus creating the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters creating health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

Flooded areas and flood damages - The areas in the Towns of Randolph and Bethel that would be flooded by the Standard Project and Intermediate Regional Floods are shown on Plates 3, 6-8, 13, and 16-18. Plate 2 is an index map of the above exhibits. The actual limits of these overflow areas may vary somewhat from those shown on the maps because the 20 foot contour interval and scale of the maps do not permit precise plotting of the flooded area boundaries. Plates 4, 5, 9-12, 14, 15, and 19-22 show water surface profiles of the floods, and are arranged to correspond with the area maps. Depth of flow at any particular point can be estimated from these illustrations.

Regarding the highwater marks of the 1927 flood shown on the profiles, it should be noted that natural and man-made conditions have, in most places, changed markedly since that time. In certain places the marks would seem to indicate that the flood was more severe than the Standard Project Flood. It should be stressed that should weather and runoff conditions identical to the 1927 flood reoccur at any time in the near future, the resultant flows and

crest elevations would generally be between the Standard Project and Intermediate Regional floods.

As can be seen from the exhibits, floodflows from the White River and its tributaries cover large portions within the study area. The areas that would be flooded include commercial, industrial, and residential and agricultural sections and the associated streets, roads and private and public utilities in the towns of Randolph and Bethel. Considerable damage to these facilities would occur during an Intermediate Regional Flood. However, due to the wide extent, greater depths, higher velocity, and longer duration of a Standard Project Flood, damage would be even more severe than during an Intermediate Regional Flood.

Obstructions - During floods, debris collecting on bridges and culverts could decrease their carrying capacity and cause greater water depths (backwater effect) upstream of these structures. Since the occurrence and amount of debris are random and indeterminate factors, only the physical characteristics of the structures were considered in preparing profiles of the Intermediate Regional and Standard Project Floods. Similarly, the maps of flooded areas do not reflect increased water surface elevations that could be caused by debris collecting against the structures, or by deposition of silt in the stream channel under structures. As previously indicated, the dams in the study area have no flood control capacity. Of the bridges in the study area, several would cause obstructions to the Intermediate Regional and Standard Project Floods. Table 6 lists water surface elevations at bridges crossing streams in the study area. Photographs of important obstructions are also included in this report.

Velocities of flow - Velocities of flow during floods depend largely upon the size and shape of the cross section, the condition of the stream, and the bed slope, all of which vary on different streams and at different locations on the same stream. In the vicinity of the Randolph playground, the Intermediate Regional Flood has an estimated maximum channel velocity of 11 feet per second, with overbank velocity of 2 feet per second. In the Standard Project Flood, the velocities at the location are 12 and 3 feet per second, respectively. At the Church Street bridge in Bethel, in the narrow section just upstream from the dam, estimated channel velocity is 16 feet per second in the IRF, and 20 feet per second in the SPF. It should be noted that water flowing at 2 feet per second or less in flood plain areas would deposit silt and debris.

TABLE 6

ELEVATION DATA

Bridges in the Study Area

Identification	Mileage Above Mouth	Under-Clearance Elevation (a)	Water Surface Elevation (a) IRF	SPF
White River				
River St., Bethel (Rte 107)	25.3	541.5	537.6	545.7
Third Branch				
Town Road	0.1	538.7	543.1	547.3
Central Vermont R.R.	0.4	562.5	542.0	546.0
Church St., Bethel (Rte 12)	0.5	573.7	564.0	570.0
Central Vermont R.R.	0.7	568.6	567.4	578.0
Town Road	2.6	588.0	585.0	589.0
Central Vermont R.R.	3.1	594.5	593.7	604.4
Main St. Randolph (Rte 12)	10.0	666.0	651.2	654.9
Central Vermont R.R.	11.3	688.0	674.5	679.1
Ayers Brook				
Central St., Randolph (Rte 66)	0.2	634.8	637.5	640.2
Forest St., Randolph (Rte 12)	0.6	653.0	640.5	643.5
Private Road	2.8	658.7	662.0	663.0
Peth Rd.	3.5	667.5	671.0	672.0
Second Branch				
East Bethel Village	4.1	540.0	545.0	546.5
Town Road, E. Bethel	4.4	540.6	547.3	550.8
Town Road, (covered bridge)	5.0	540.8	547.8	551.2
Rte. 14	6.0	545.2	550.4	554.5
Farm Bridge	6.5	545.5	551.8	555.4
Private Road	7.3	554.8	557.7	560.1
Farm Bridge (covered bridge)	9.0	567.0	576.0	580.4
Rte 14	9.2	570.8	576.5	580.6
Town Road (covered bridge)	10.0	576.5	582.1	584.7
Rte. 14, E. Randolph	10.9	600.0	601.0	602.1
Rte. 14	12.6	627.1	626.0	631.5
Rte. 14	13.2	639.6	645.4	650.4

(a) Feet, mean sea level datum

Rates of rise and duration of flooding - The more critical floods, which can occur in any month of the year, develop from rainfall alone where the intensity of the rainfall, rather than the total volume, may determine the magnitude of the flood peaks. The quick development of floods is due to the many short, steep tributaries which empty into the main channels concurrently. This is illustrated by the fact that, in major floods, the White River and tributaries can crest within a period of 6 to 12 hours, rising at a maximum rate of 1 to 2 feet per hour. The duration of critical stage (period of time flooding is above critical stage level) is generally not more than one to two days.

Photographs, future flood heights - The levels that the Intermediate Regional and Standard Project Floods are expected to reach at various locations in the study area are indicated on the following photographs (see Figures 10 through 14):

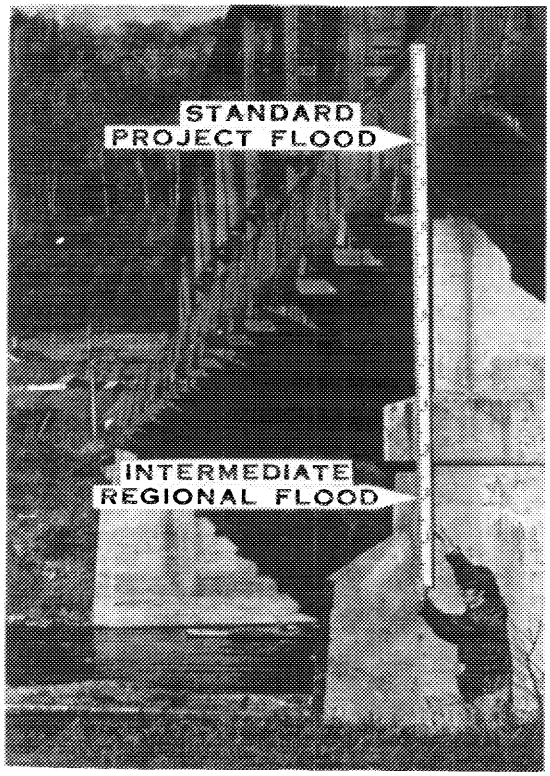


Figure 10 - Future flood heights at River Street bridge, Bethel.

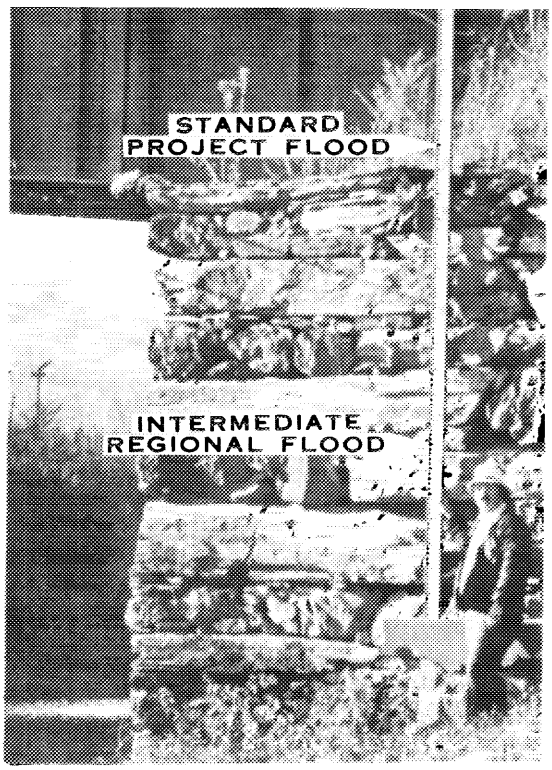


Figure 11 - Future flood heights at Church Street bridge, Bethel.

Figure 12 - Future flood heights at Central Street bridge, Randolph.

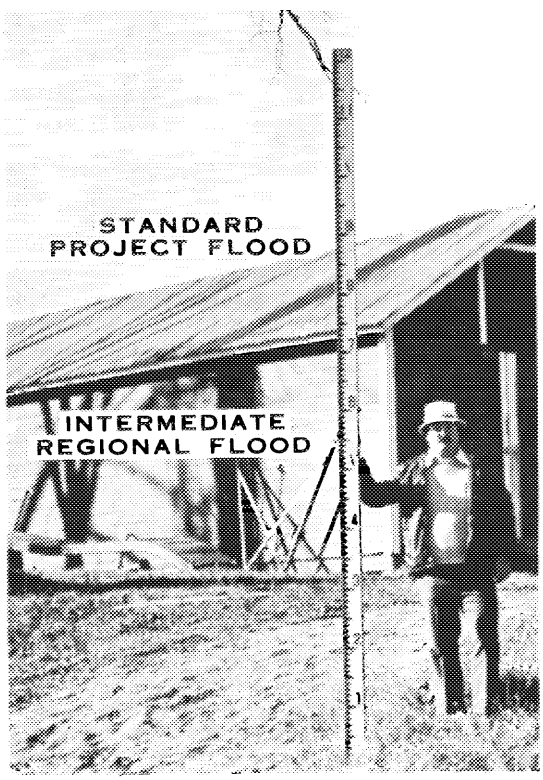


Figure 13 - Future flood heights at Randolph playground.

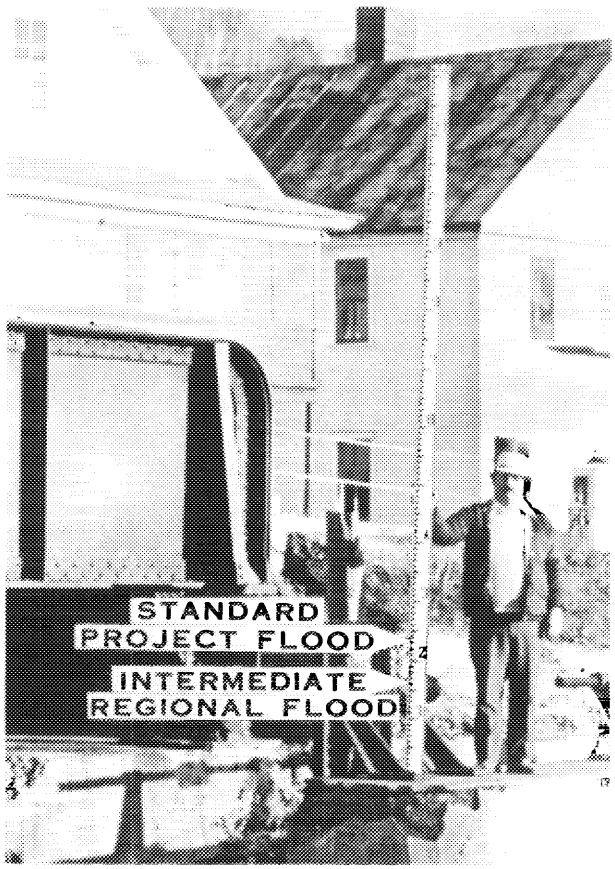


Figure 14 - Future flood heights at East Randolph dam.

GLOSSARY

Backwater. The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

Flood. An overflow of water onto lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally, a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased streamflow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Hydrograph. A graph showing the stage in feet against time at a given point and the rate of rise and duration above flood stage.

Flood Plain. The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water, which have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Hurricane. An intense cyclonic windstorm of tropical origin in which winds tend to spiral inward in a counterclockwise direction toward a core of low pressure with maximum surface wind velocities that equal or exceed 75 miles per hour (65 knots) for several minutes or longer at some points. Tropical storm is the term applied if maximum winds are less than 75 miles per hour.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed."

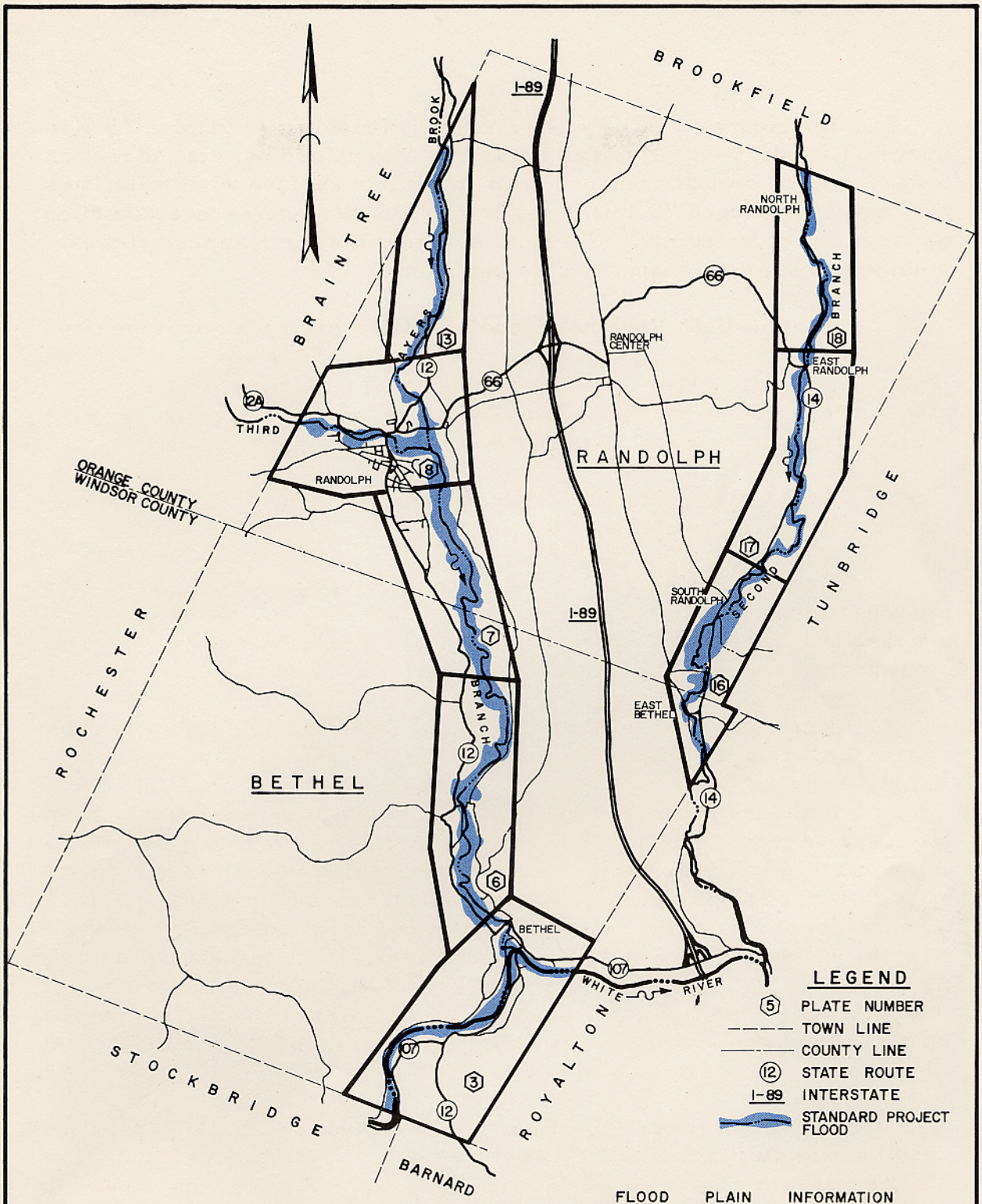
Left Bank. The bank on the left side of a river, or watercourse looking downstream.

Probable Maximum Flood. A hypothetical flood representing the most severe flood with respect to volume, concentration of runoff and peak discharge that may be expected from a combination of the most severe meteorological and hydrological conditions in the region.

Right Bank. The bank on the right side of a river, or watercourse looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of the Probable Maximum Floods for the same basins. As used by the Corps of Engineers, Standard Project Floods are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance Elevation. The elevation at the top of the opening of a culvert or other structure through which water may flow along a watercourse. This is sometimes referred to as "low steel" in some regions.



FLOOD PLAIN INFORMATION

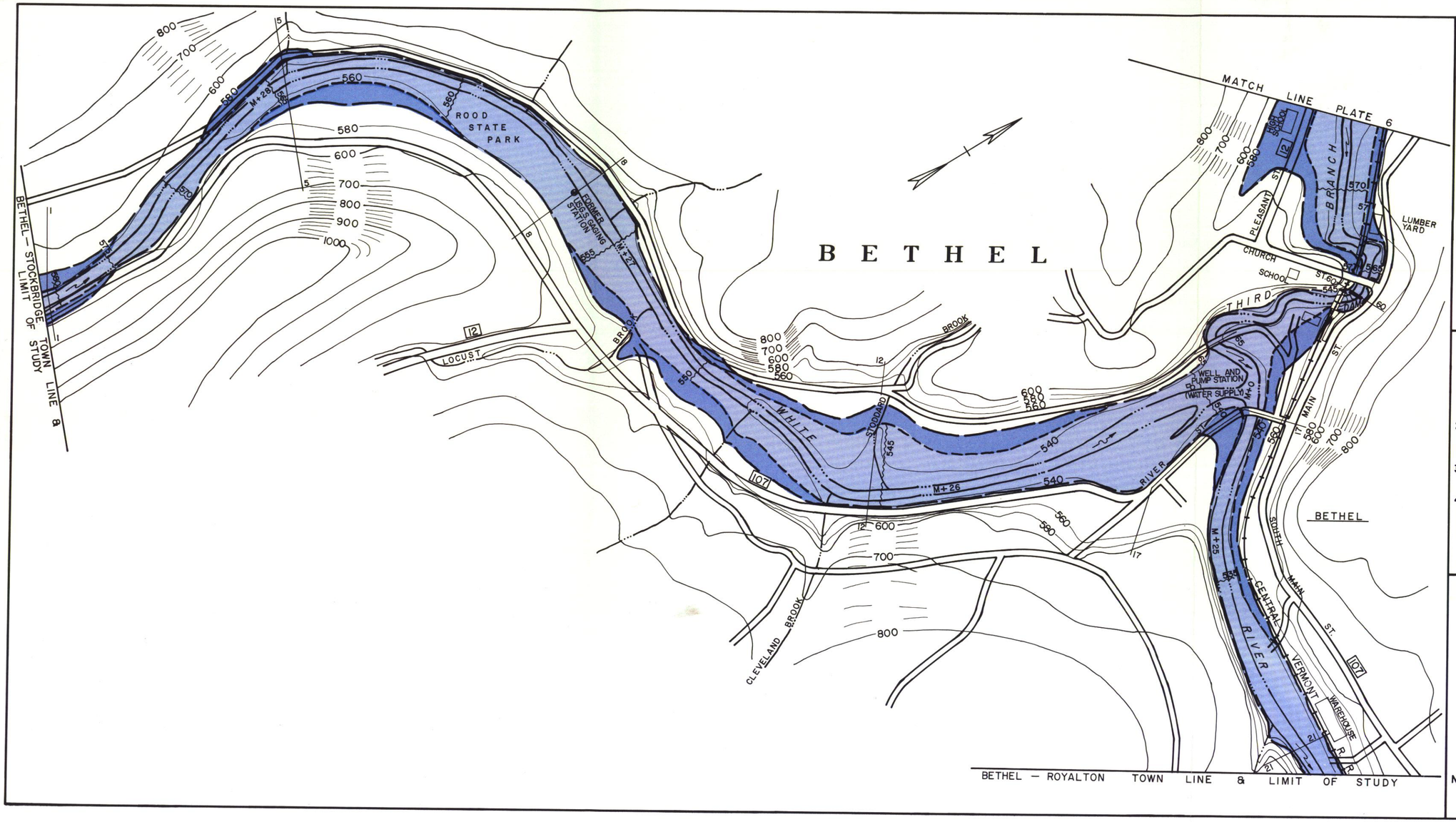
TOWNS OF RANDOLPH & BETHEL

VERMONT

INDEX MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

NOVEMBER, 1973



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M + 25 — MILES ABOVE MOUTH OF THE WHITE RIVER

700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL

CHANNEL

12 — 12 STREAM CROSS-SECTION

12 STATE ROUTE NUMBER

545 INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

0.1 0 0.1 0.2 0.3

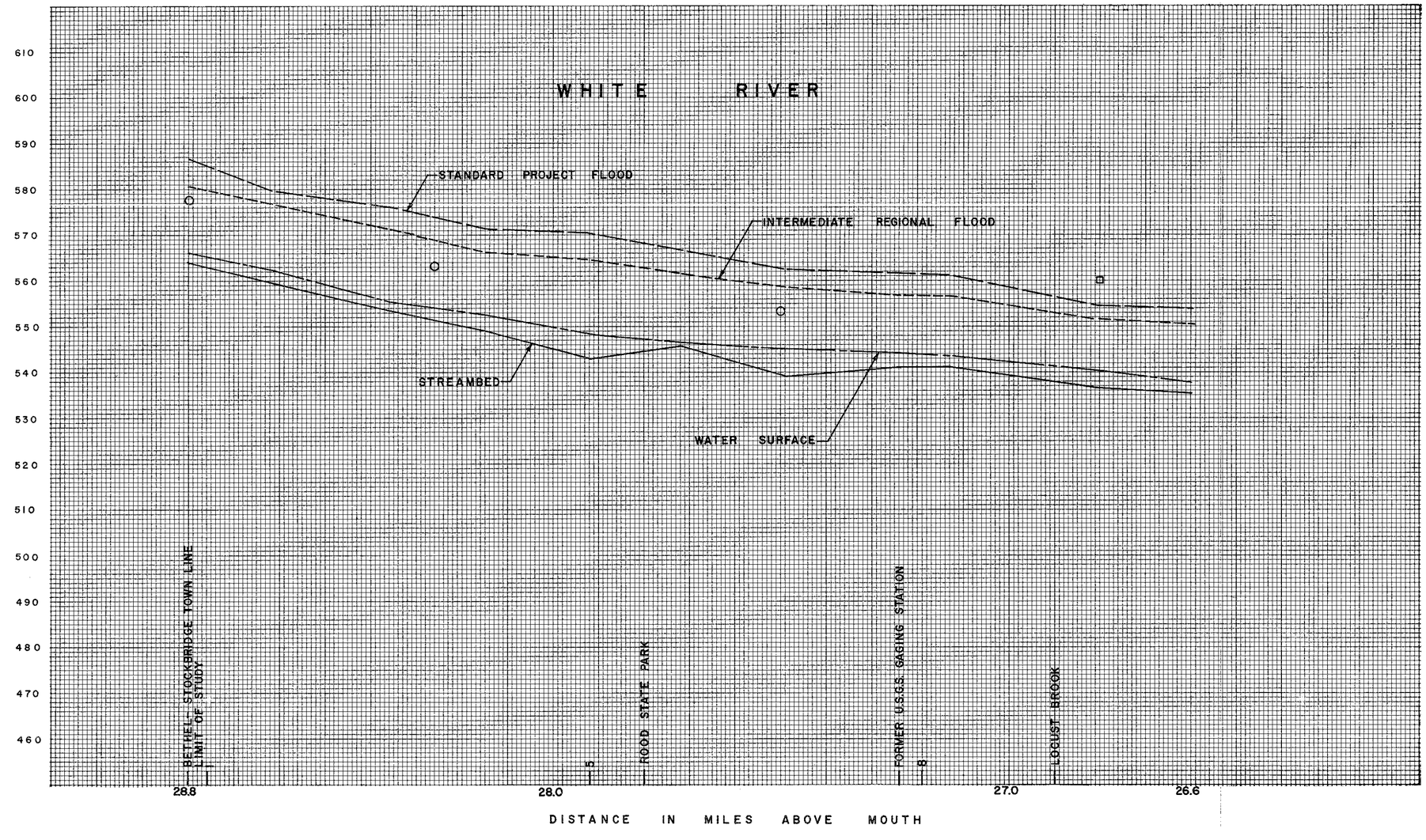
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS — WHITE RIVER

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 3



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS-SECTION

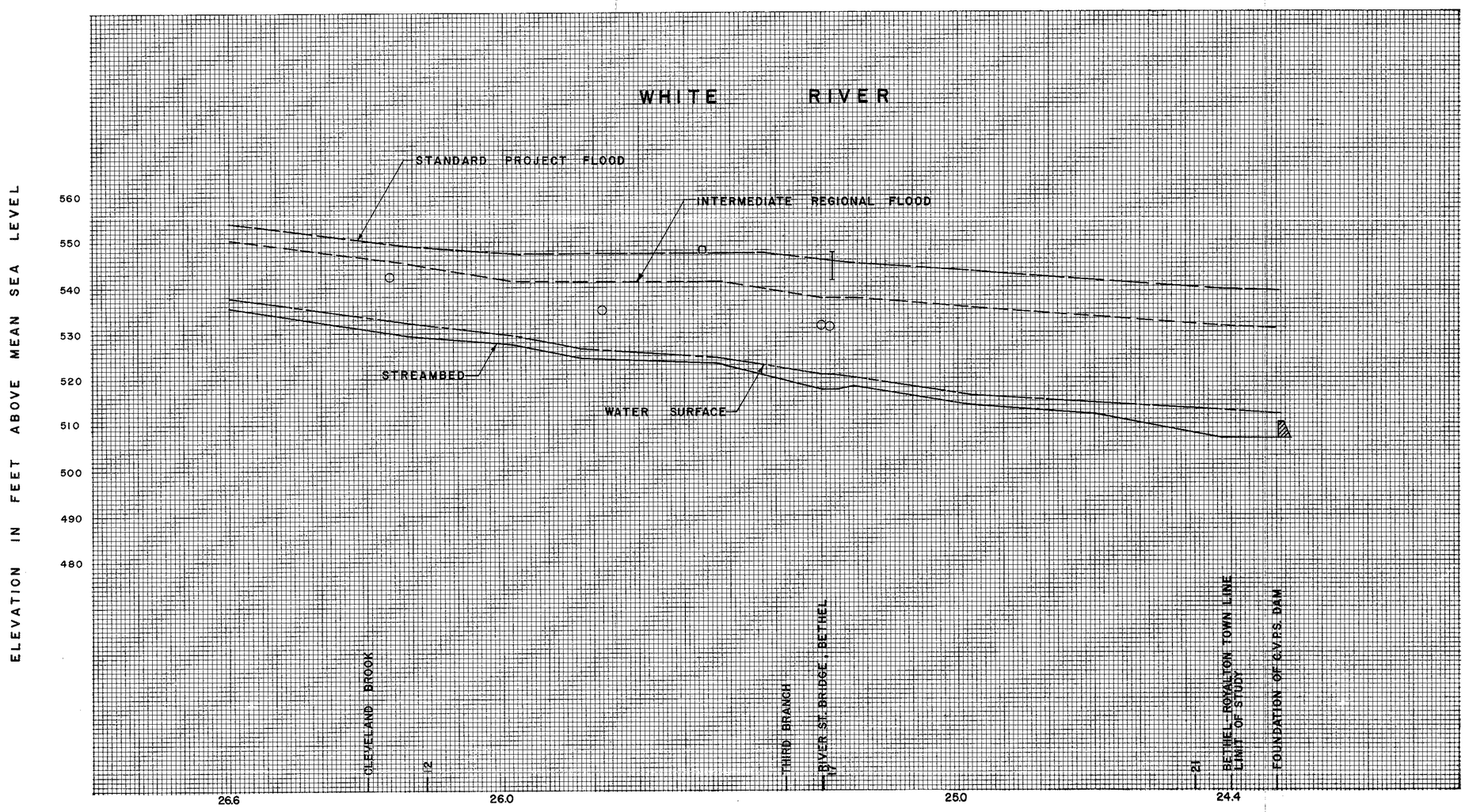
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES WHITE RIVER

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 4



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS-SECTION

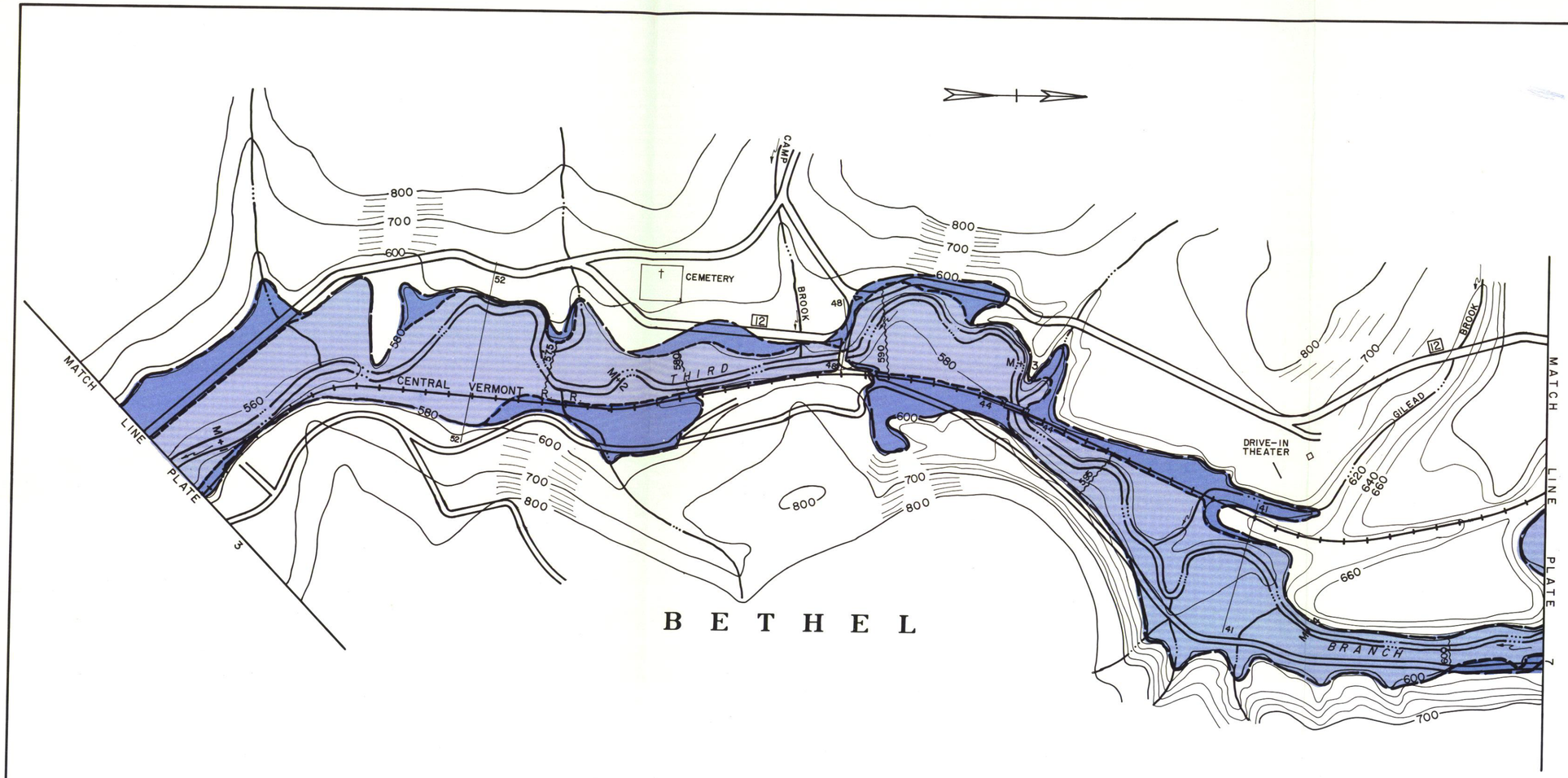
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES WHITE RIVER

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 5



LEGEND

OVERFLOW LIMITS

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD
- M + 3 — MILES ABOVE MOUTH OF THE THIRD BRANCH
- 700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- CHANNEL
- 41 41 — STREAM CROSS-SECTION
- 12 — STATE ROUTE NUMBER
- 590 — INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

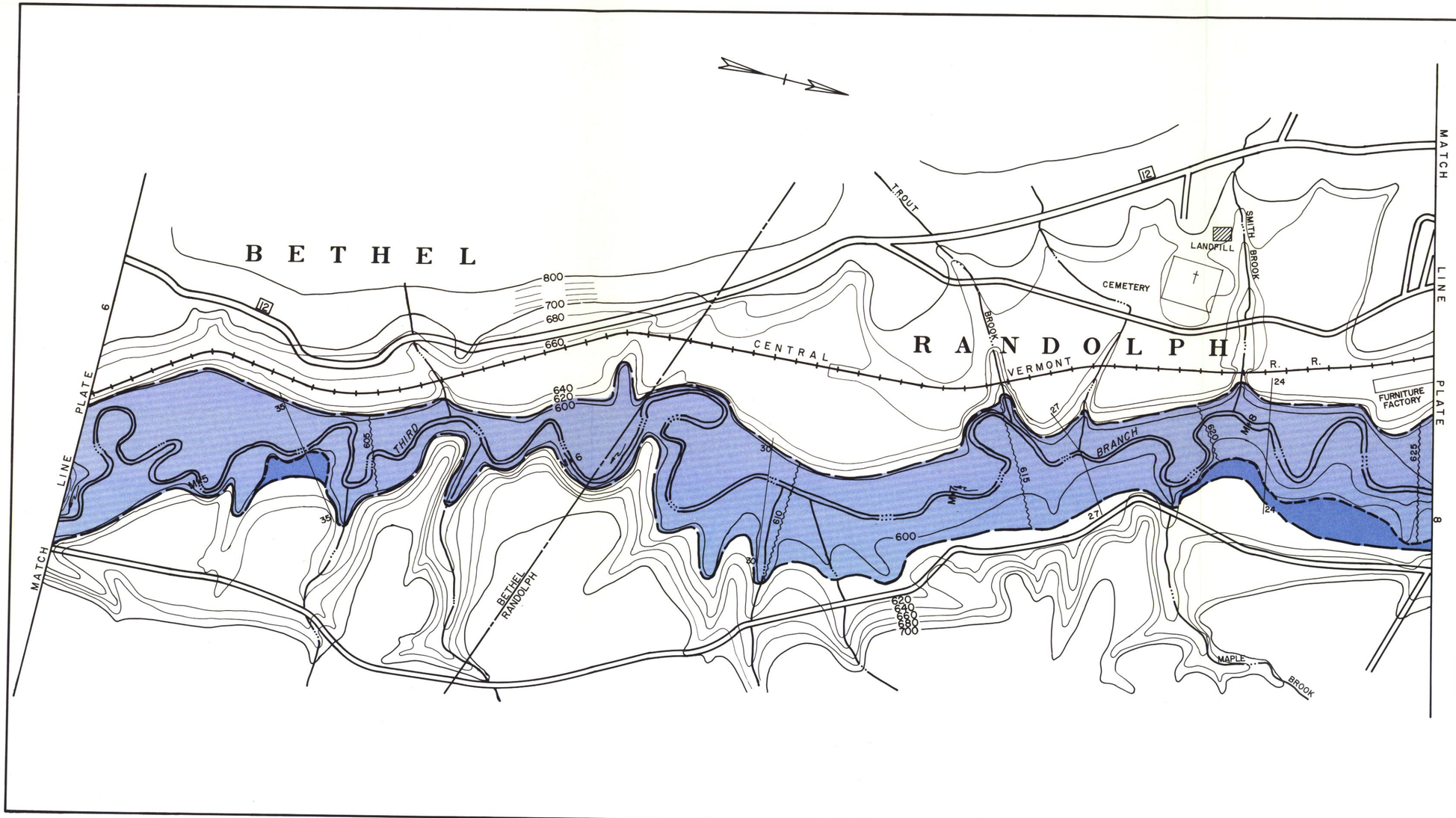
0.1 0 0.1 0.2 0.3

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS - THIRD BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS



LEGEND

OVERFLOW LIMITS

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD
- M + 7 — MILES ABOVE MOUTH OF THE THIRD BRANCH
- 700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- CHANNEL
- 30 30 — STREAM CROSS-SECTION
- 12 — STATE ROUTE NUMBER
- 615 — INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

0.1 0 0.1 0.2 0.3

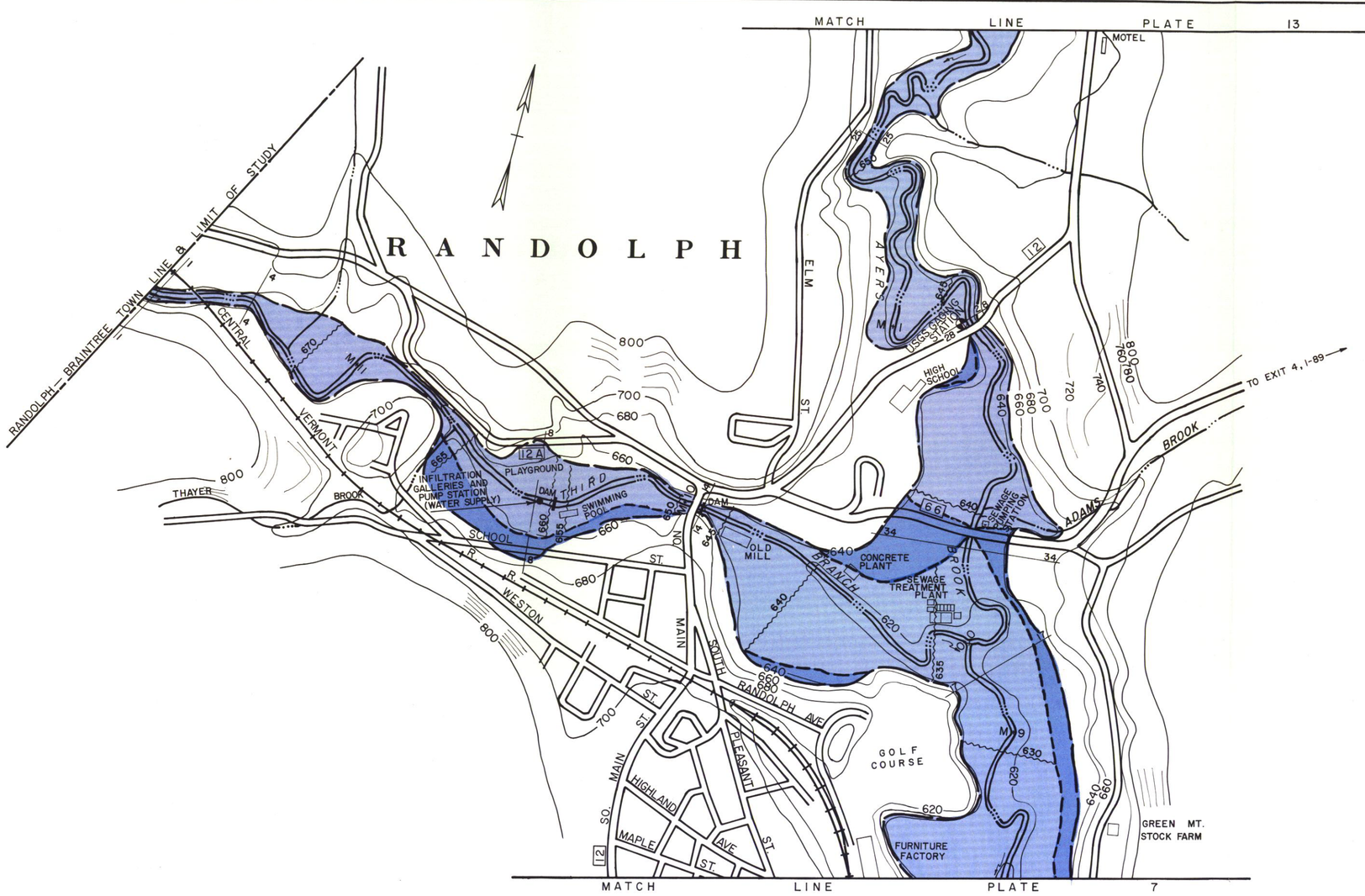
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS - THIRD BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 7



LEGEND

OVERFLOW LIMITS

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD
- M + 9 — MILES ABOVE MOUTH OF THE THIRD BRANCH
- 700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- CHANNEL
- 17 17 — STREAM CROSS-SECTION
- 12 — STATE ROUTE NUMBER
- 640 — INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

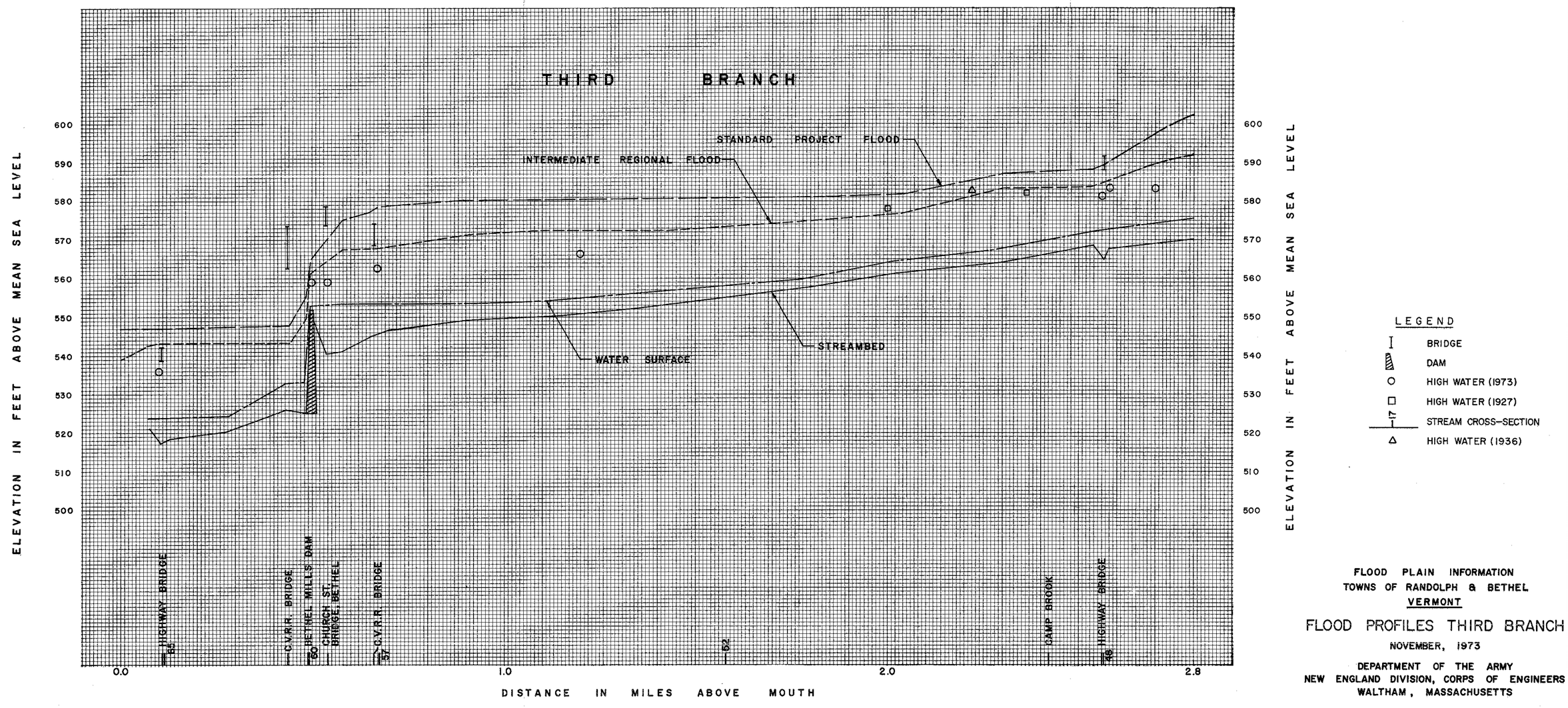
0.1 0 0.1 0.2 0.3

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS - THIRD BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

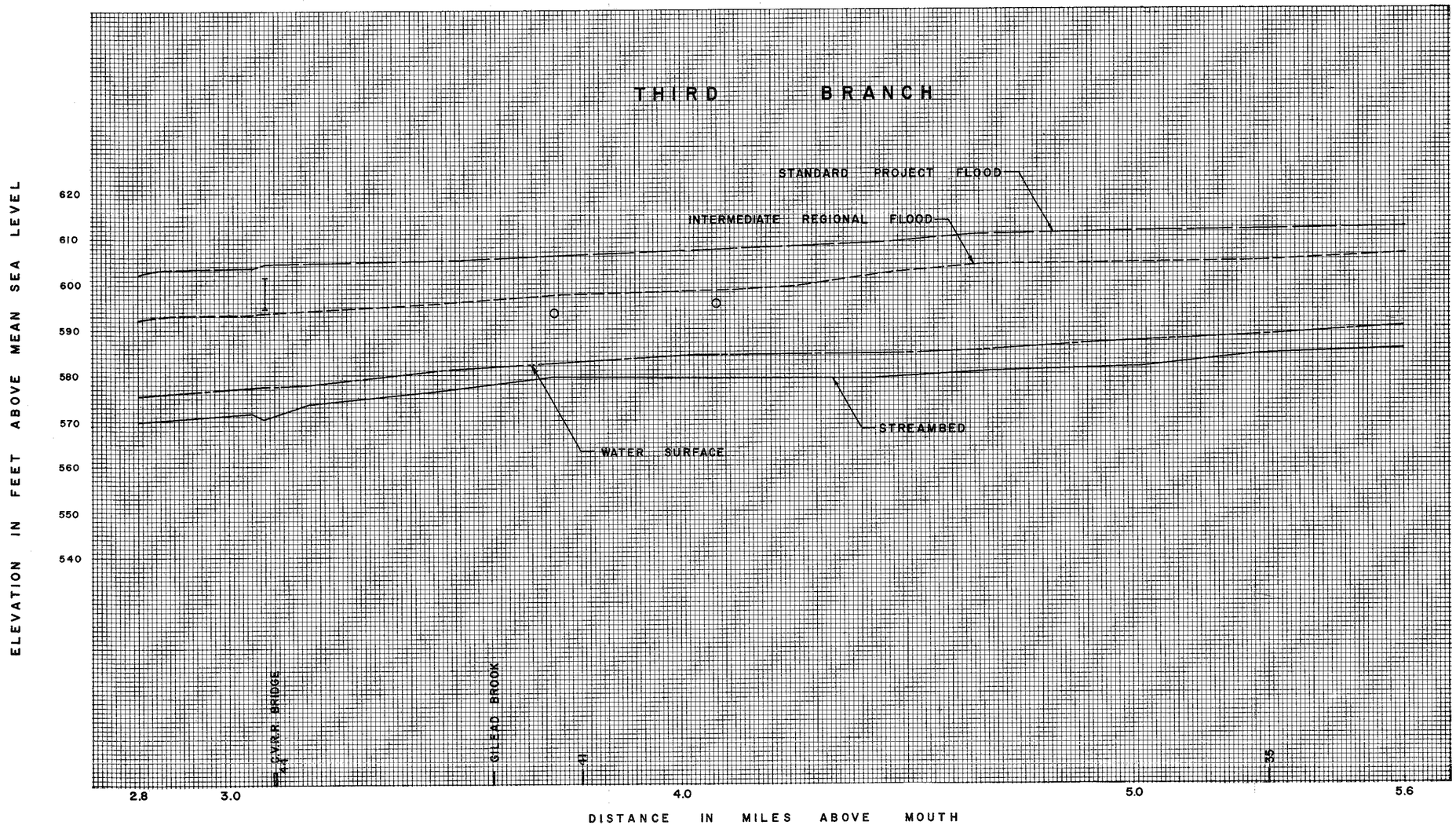


FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES THIRD BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS SECTION

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES THIRD BRANCH

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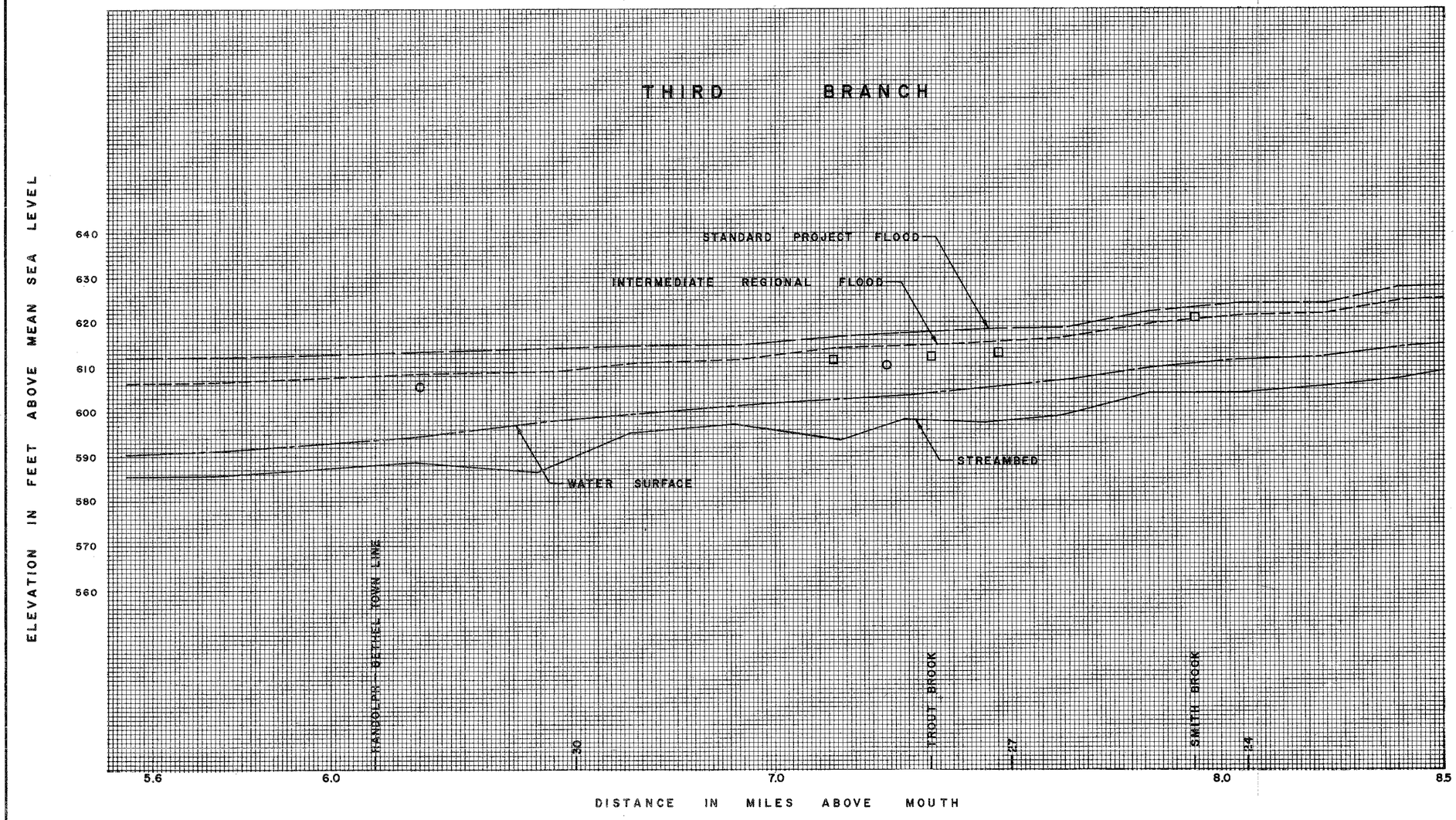
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 10



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS-SECTION

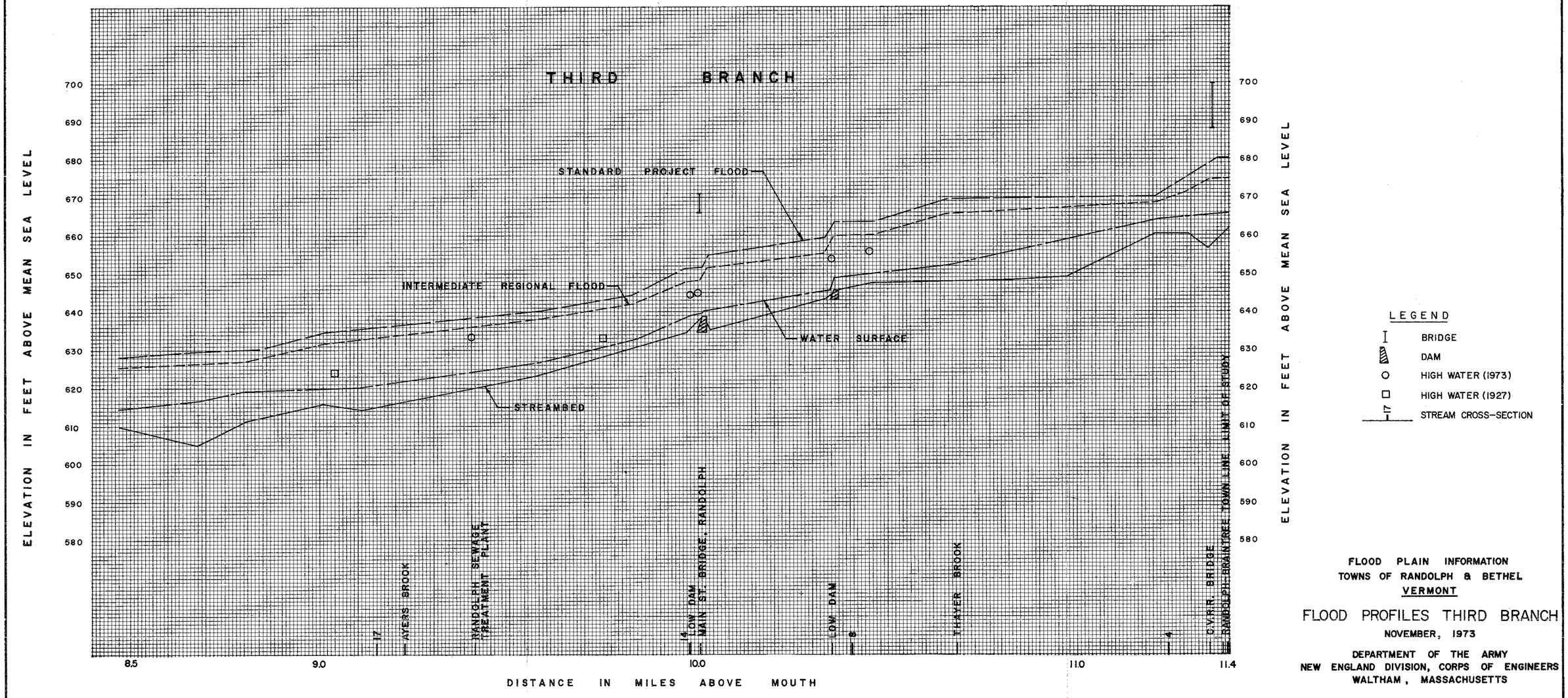
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES THIRD BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 11



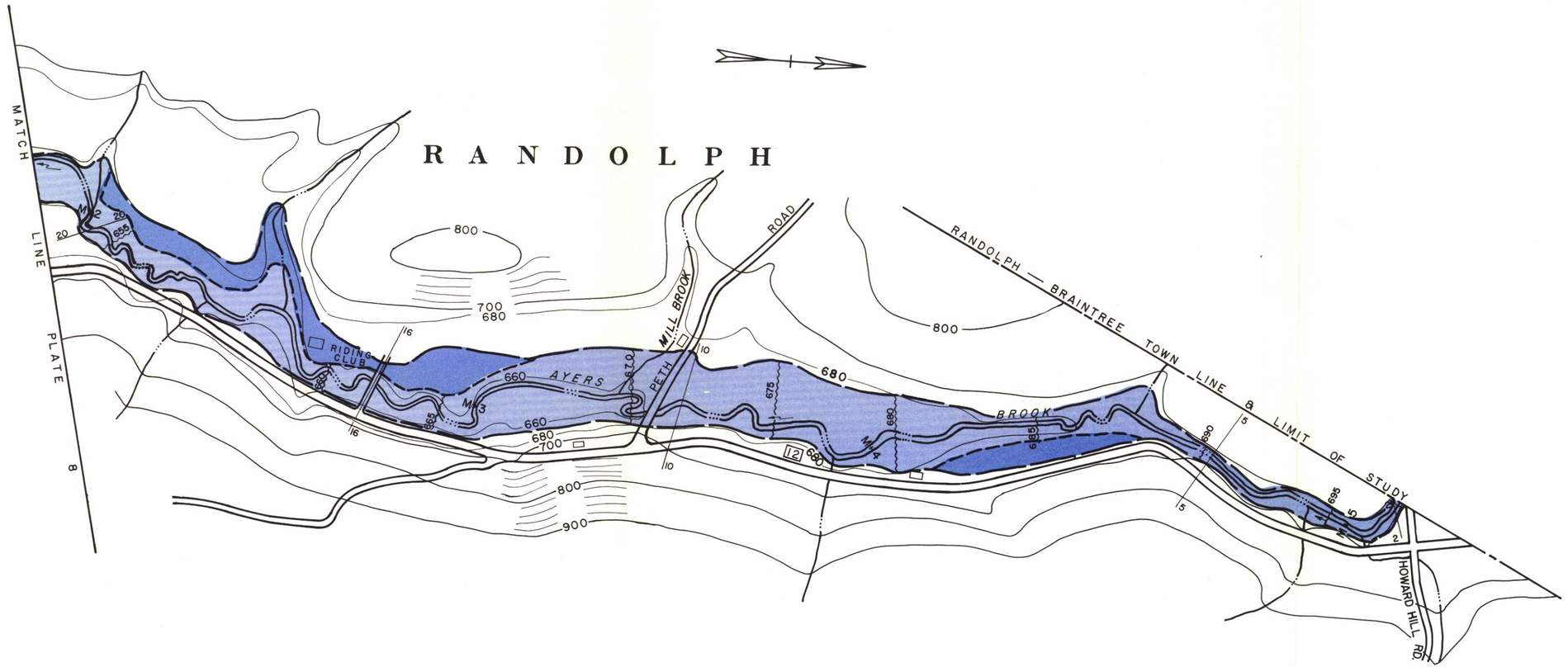
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES THIRD BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 12



LEGEND

OVERFLOW LIMITS

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD
- M + 4 — MILES ABOVE MOUTH OF THE AYERS BROOK
- 700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- CHANNEL
- 10 — 10 STREAM CROSS-SECTION
- 12 — STATE ROUTE NUMBER
- 680 — INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

0.1 0 0.1 0.2 0.3

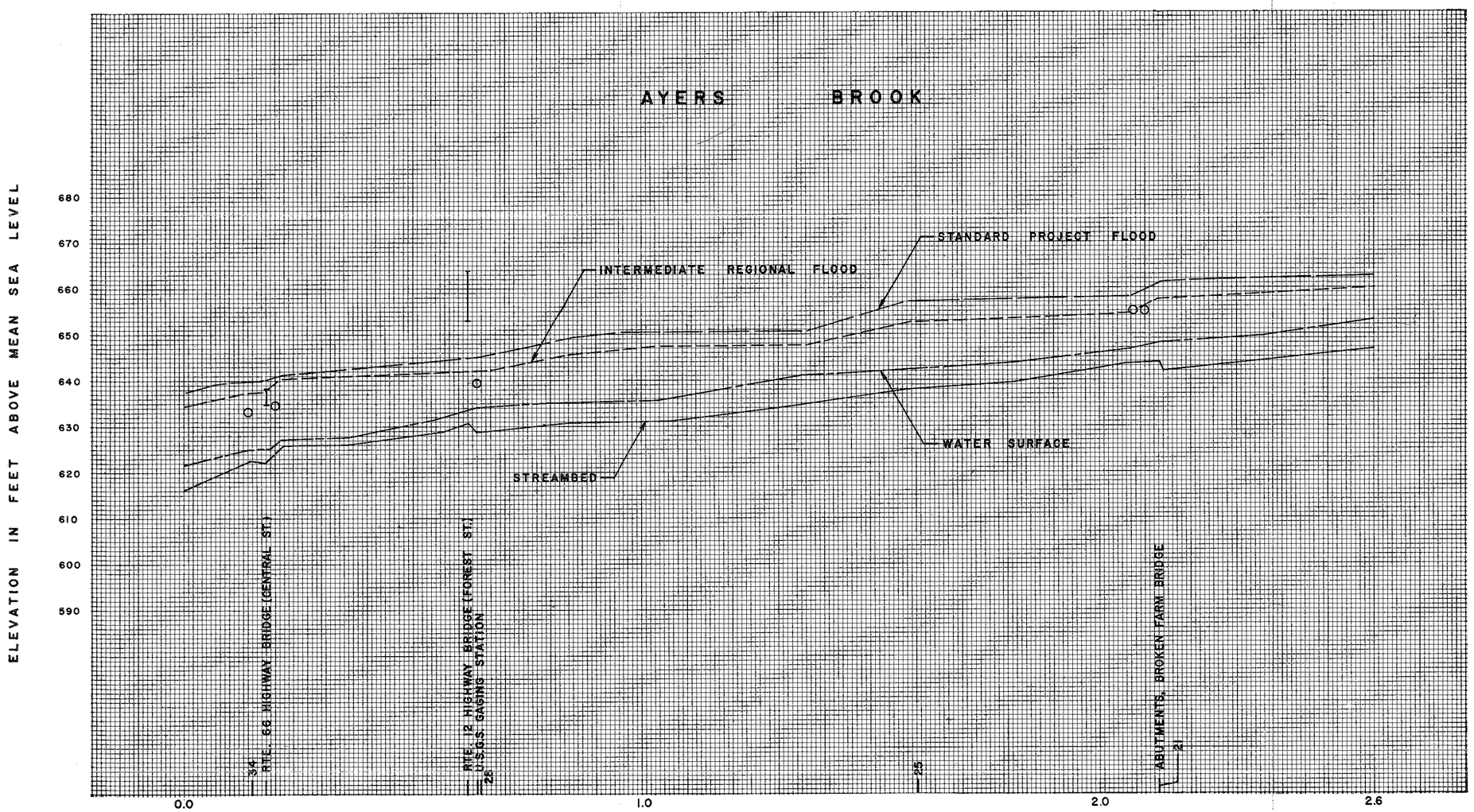
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS - AYERS BROOK

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 13



ELEVATION IN FEET ABOVE MEAN SEA LEVEL
680
670
660
650
640
630
620
610
600
590

LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS-SECTION

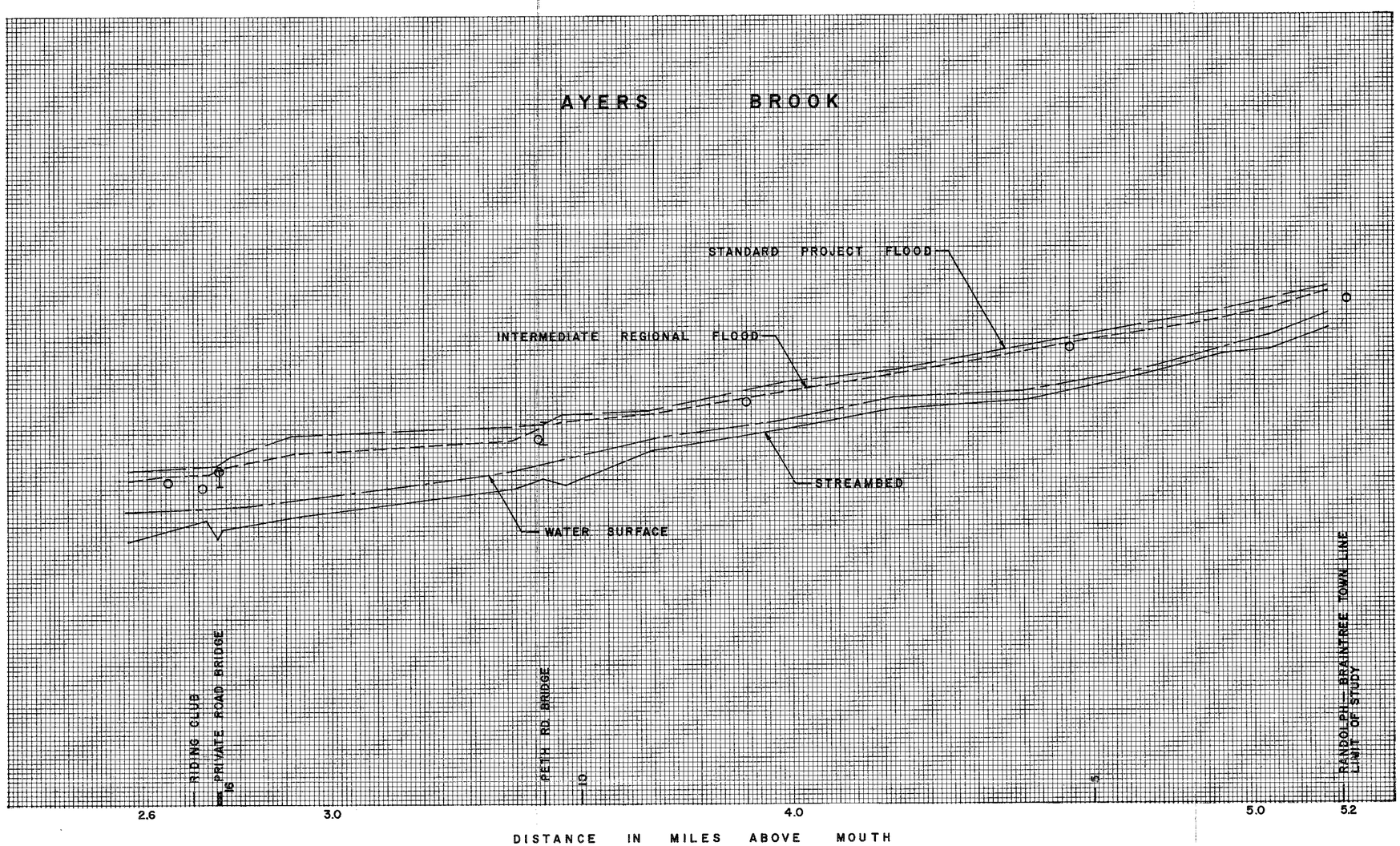
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES AYERS BROOK

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 14



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- 17 STREAM CROSS-SECTION

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES AYERS BROOK

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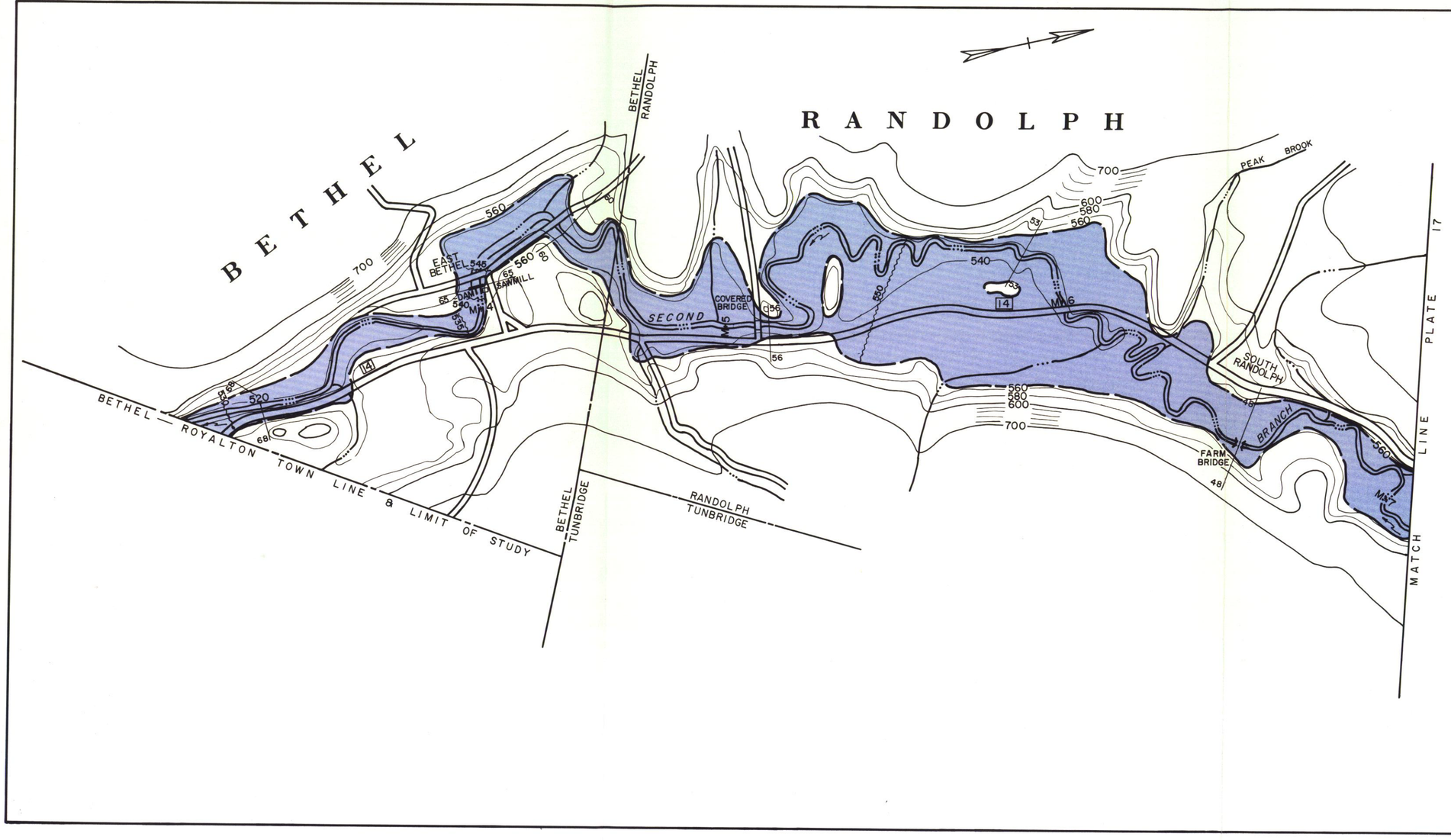
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 15



LEGEND

OVERFLOW LIMITS

- INTERMEDIATE REGIONAL FLOOD (Standard Project Flood Covers Approximately The Same Area)
- M + 6 — MILES ABOVE MOUTH OF THE SECOND BRANCH
- 700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- CHANNEL
- 48 48 — STREAM CROSS-SECTION
- 14 — STATE ROUTE NUMBER
- 550 — INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

0.1 0 0.1 0.2 0.3

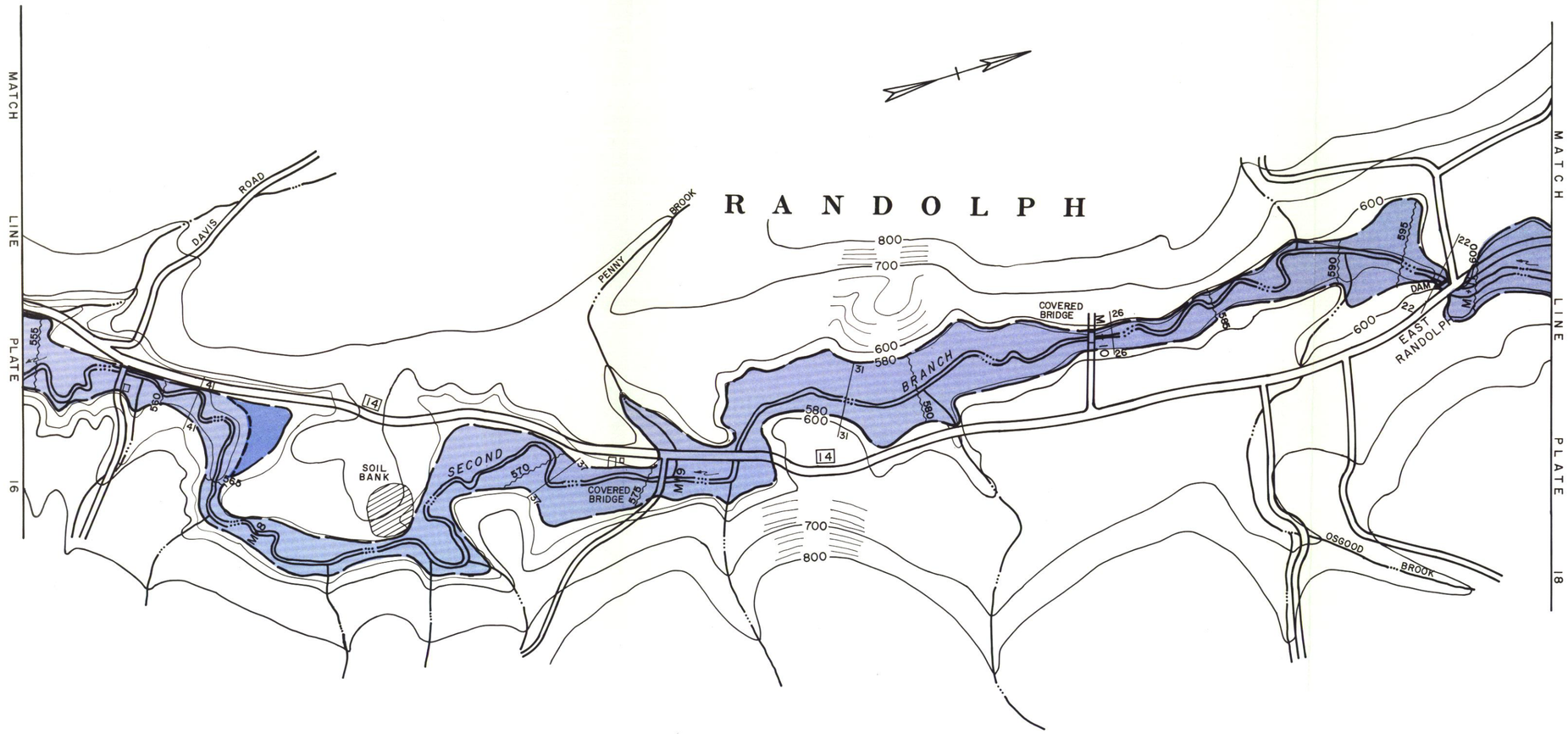
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS - SECOND BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 16



LEGEND

OVERFLOW LIMITS

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD
- M + 10 — MILES ABOVE MOUTH OF THE SECOND BRANCH
- 700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- CHANNEL
- 31 31 — STREAM CROSS-SECTION
- 14 — STATE ROUTE NUMBER
- 580 — INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

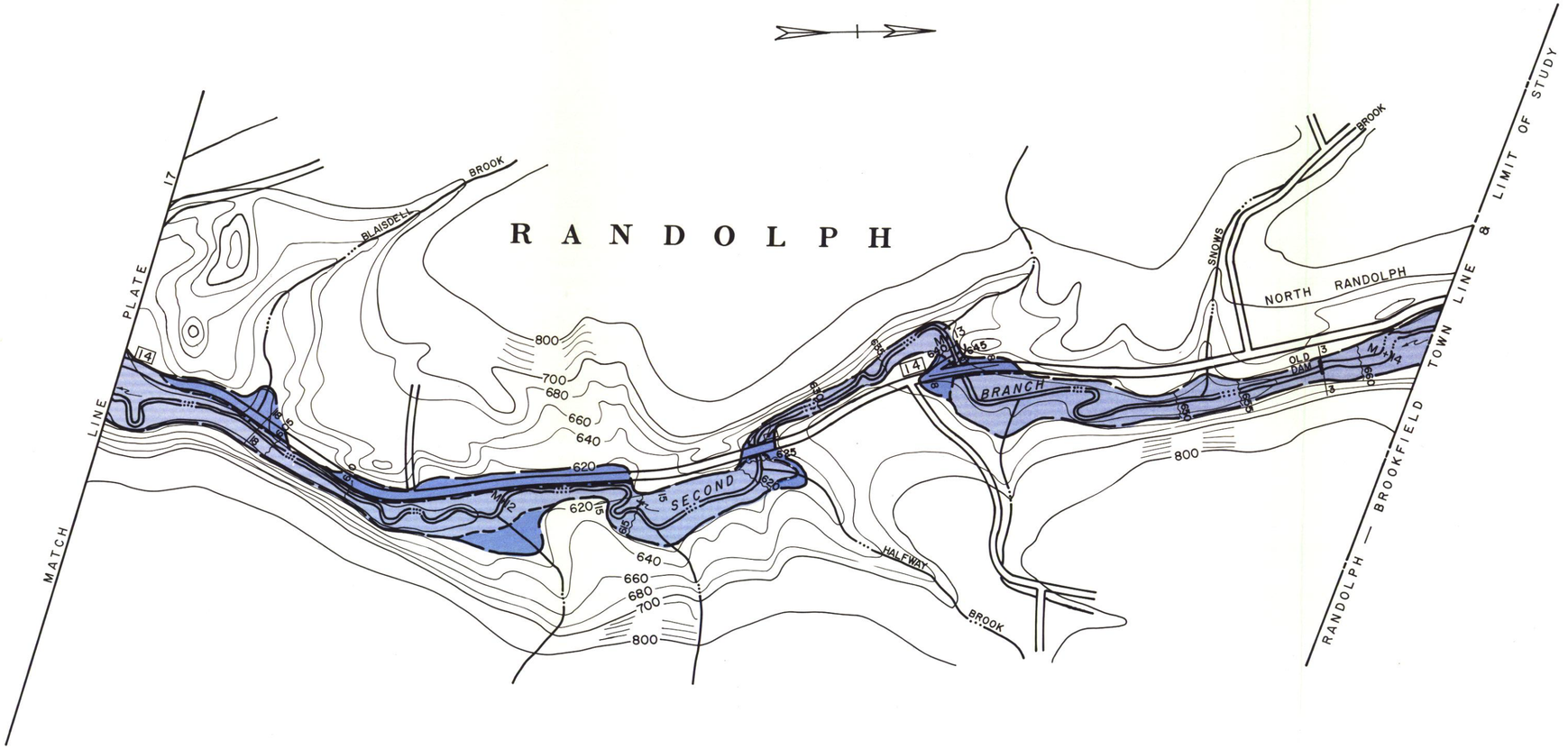
0.1 0 0.1 0.2 0.3

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS — SECOND BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS



LEGEND

OVERFLOW LIMITS

- INTERMEDIATE REGIONAL FLOOD / STANDARD PROJECT FLOOD
- M + 13 — MILES ABOVE MOUTH OF THE SECOND BRANCH
- 700 — GROUND ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- CHANNEL
- 3 — 3 STREAM CROSS-SECTION
- 14 STATE ROUTE NUMBER
- 620 INTERMEDIATE REGIONAL FLOOD ELEVATION LINE

NOTES

1. MAP BASED ON U.S.G.S. QUADRANGLE SHEET RANDOLPH, VERMONT 1957. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FEET.

SCALE IN MILES

0.1 0 0.1 0.2 0.3

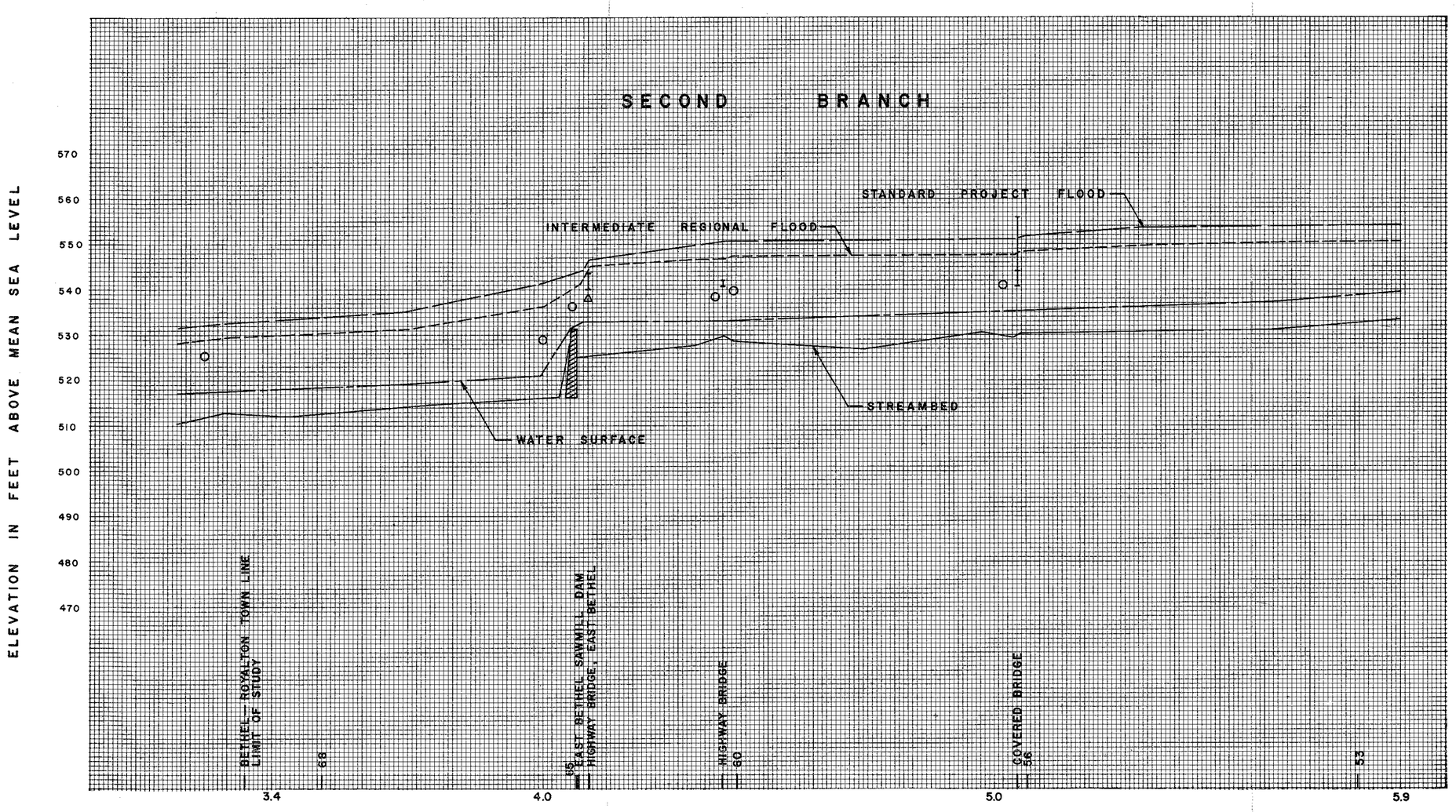
FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOODED AREAS-SECOND BRANCH

NOVEMBER, 1973

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

PLATE 18



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- 17 STREAM CROSS-SECTION
- HIGH WATER (1936)
- COVERED BRIDGE

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
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FLOOD PROFILES SECOND BRANCH

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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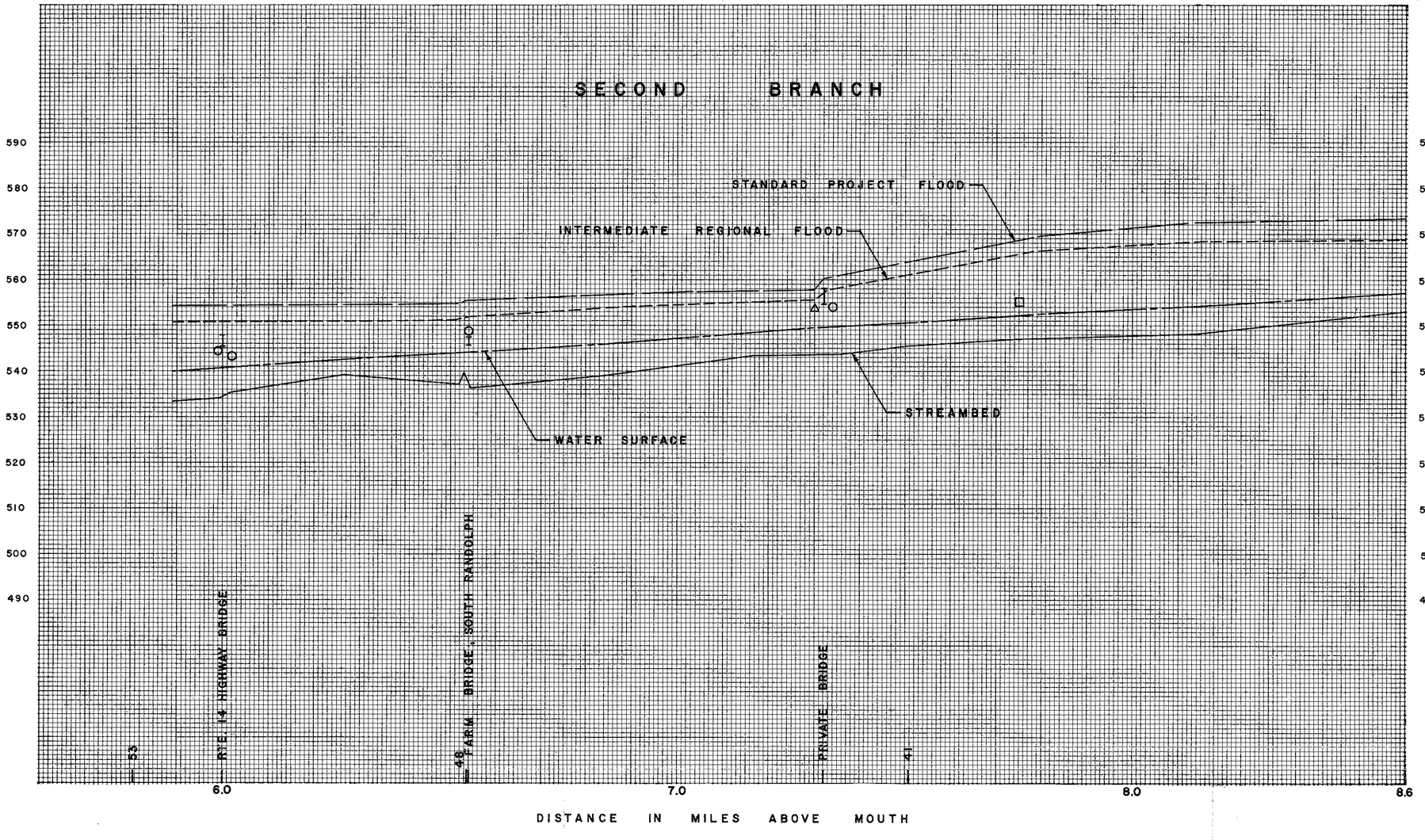
PLATE 19



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS-SECTION
- HIGH WATER (1936)

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES SECOND BRANCH

NOVEMBER, 1973

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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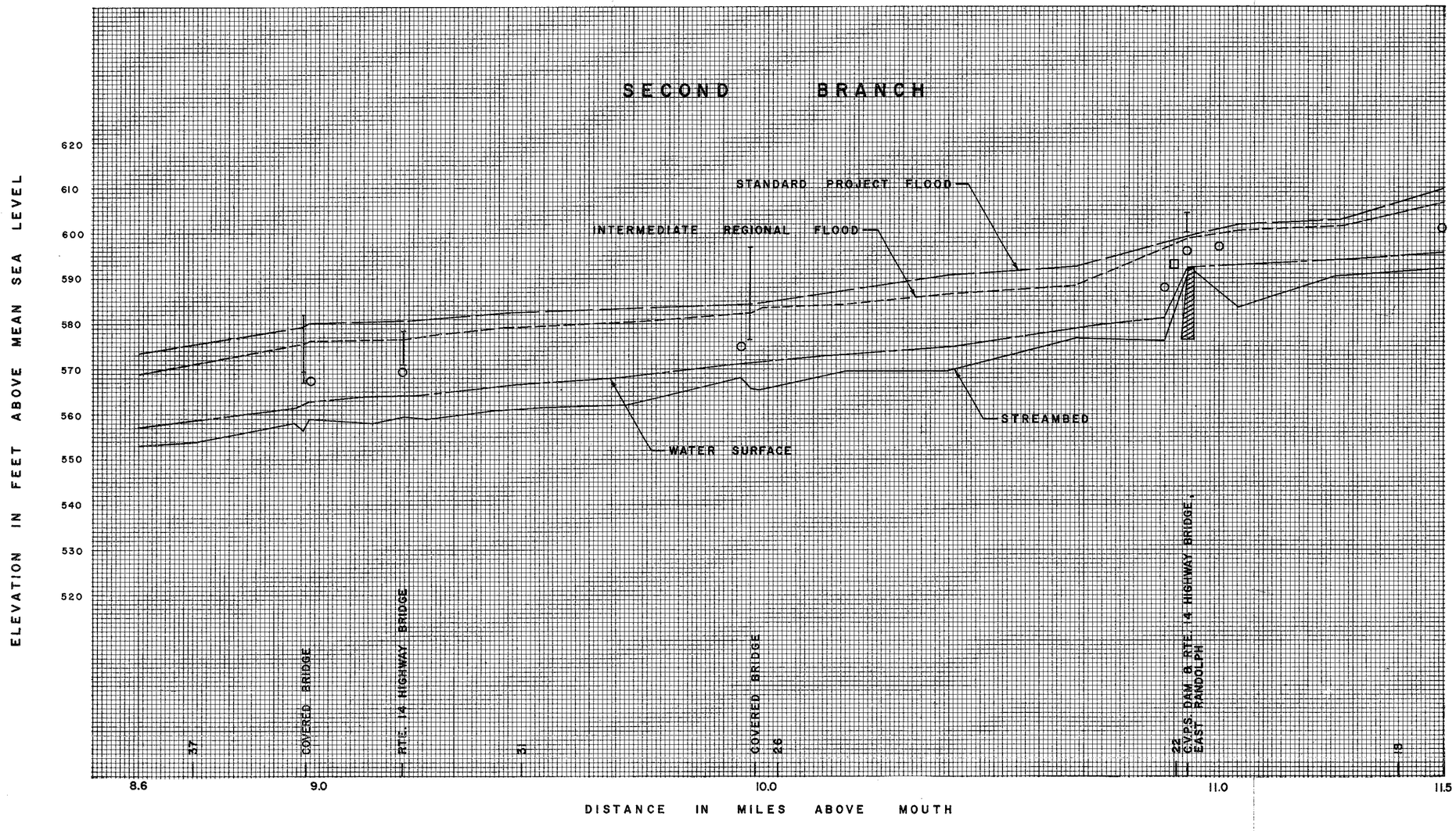
PLATE 20



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS-SECTION
- COVERED BRIDGE

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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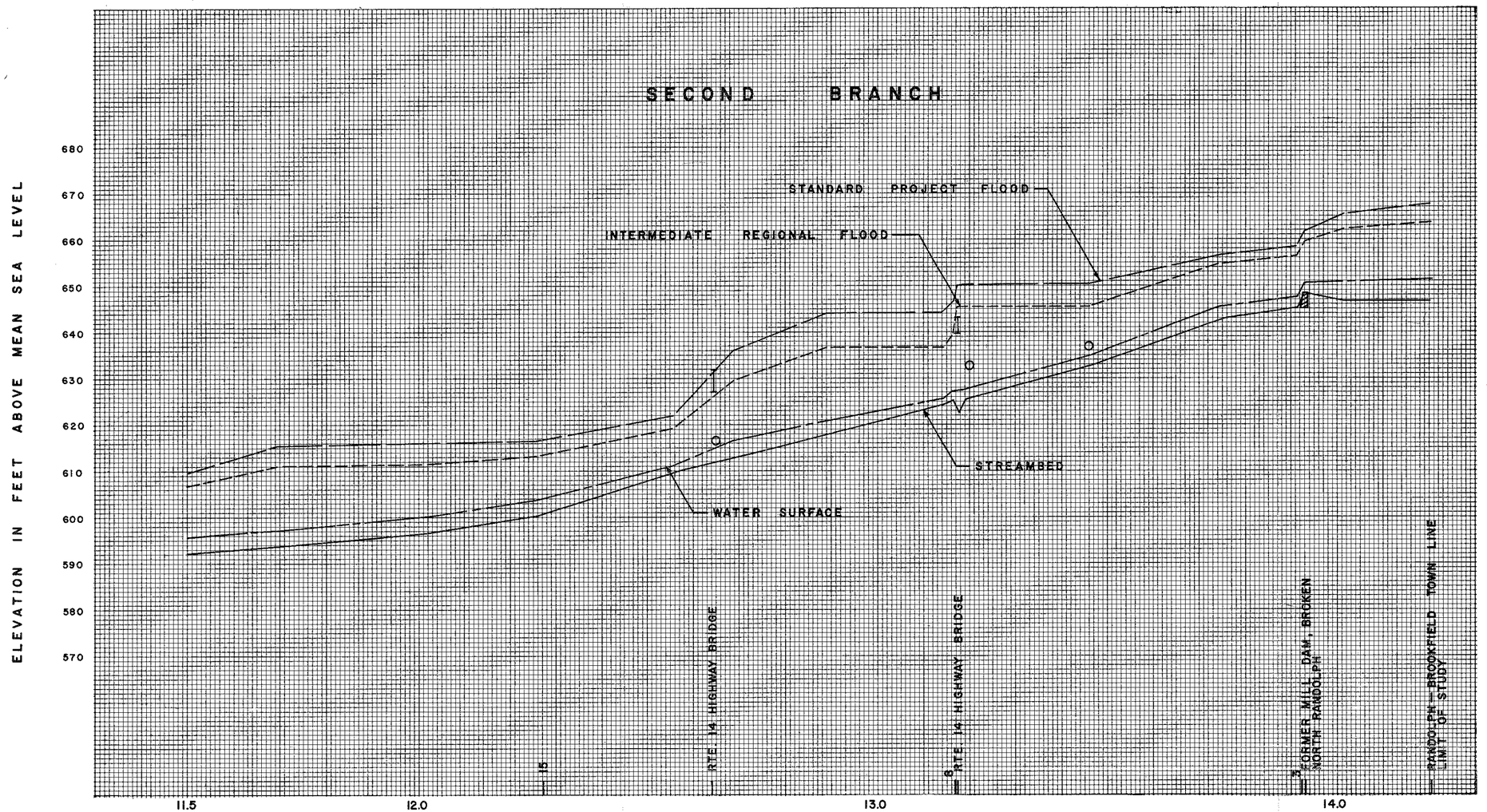
PLATE 21



LEGEND

- BRIDGE
- DAM
- HIGH WATER (1973)
- HIGH WATER (1927)
- STREAM CROSS-SECTION

FLOOD PLAIN INFORMATION
TOWNS OF RANDOLPH & BETHEL
VERMONT

FLOOD PROFILES SECOND BRANCH

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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PLATE 22